AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 4, No. 25. WEEKLY. | NEW YORK, JUNE 18, 1881. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

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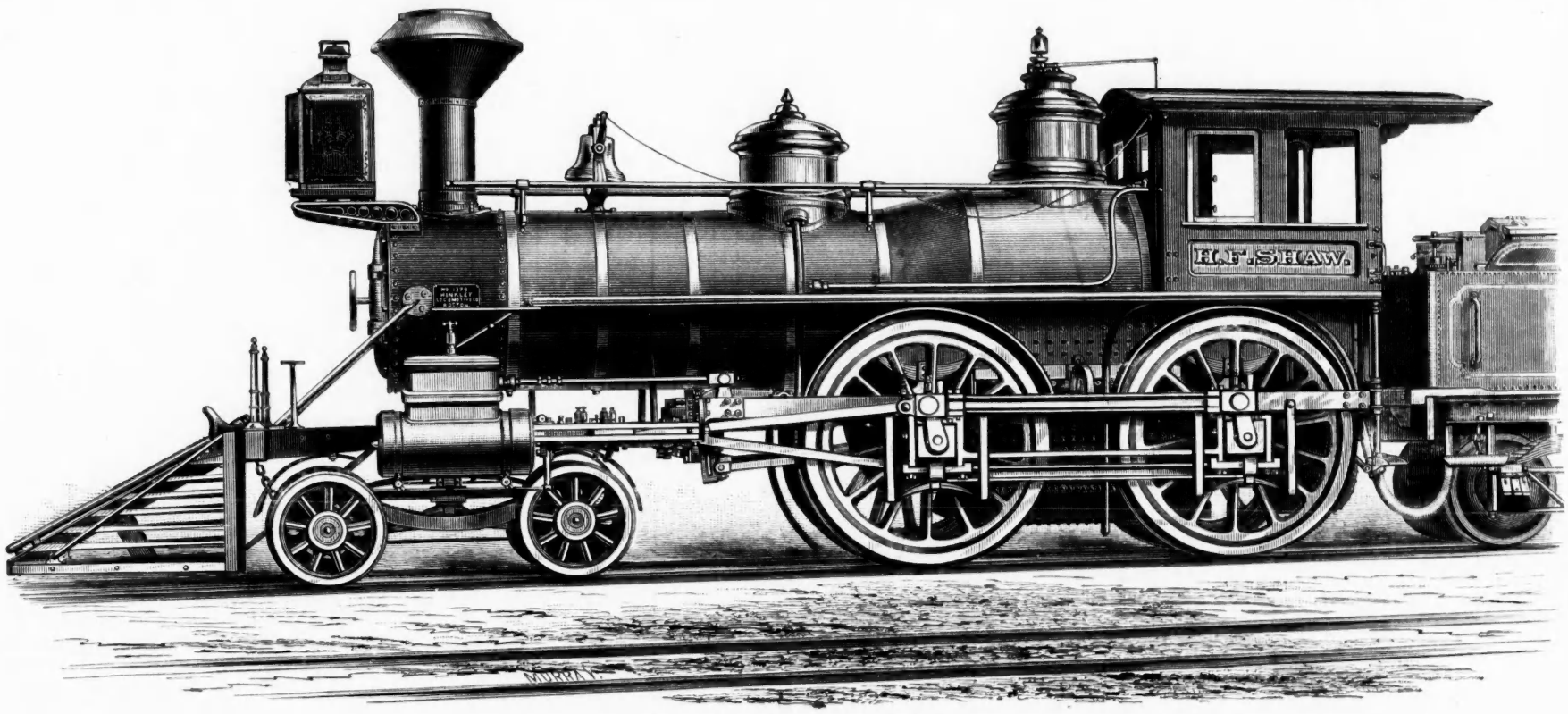


THE SHAW FOUR-CYLINDER LOCOMOTIVE.

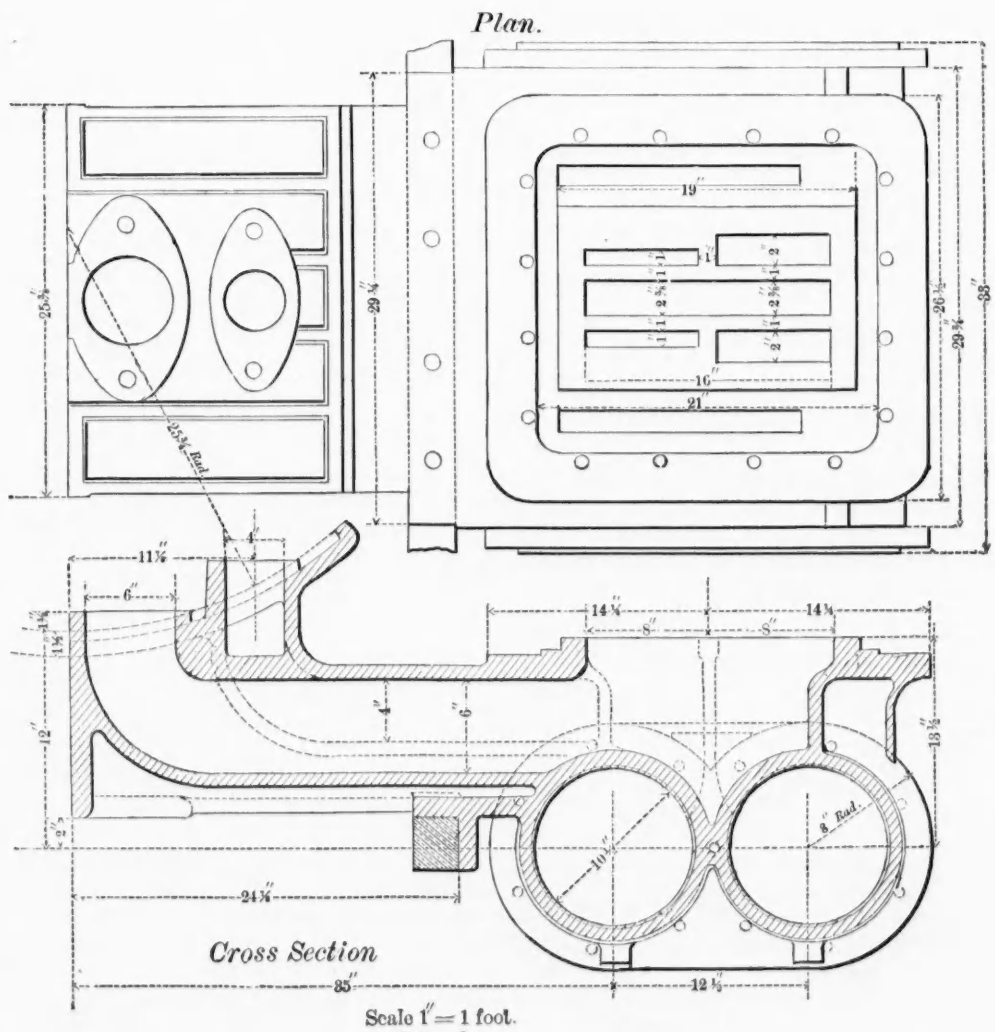
The Shaw Locomotive.

Since locomotives came into existence, it has been practically demonstrated that to balance reciprocating with rotating parts, to run steadily with each other, except at a certain speed, is impossible; and to obtain the result previously stated involves some of the finest mathematical calculations.

Many experiments have been tried in balancing locomotives, as they are now built by master mechanics, who have ideas differing greatly from each other. It is unnecessary for us to go into the details at this time, but we will say that all of these experiments were unsuccessful.

One result of the imperfect balancing of locomotives is, they are caused to oscillate violently from side to side, this being accompanied by a leaping or hitching motion, as the wheels revolve. The forces which cause these oscillations are understood to increase as the square of the angular velocity of the wheels, other things being equal; hence it is of the highest importance that a high-speed or passenger locomotive should be accurately balanced, in order that the engine may run safely; the friction being reduced to a minimum, and the life of the engine thereby prolonged.

It has also been demonstrated that the only true method of balancing a locomotive or any other piston and crank engine, to run steadily at all speeds, is to apply two pistons, cross heads and rods, each developing an equal amount of work in opposite directions.



Scale 1″ = 1 foot.

Fig. 1.

CYLINDERS OF SHAW LOCOMOTIVE.

The first engraving upon this page represents a locomotive embodying the foregoing principles. It was designed and invented by Henry F. Shaw, of West Roxbury, Mass.

The peculiarities of this locomotive will be readily understood by the aid of the engravings upon this and the following pages.

This locomotive is a 16″x24″ Hinkley, 37-ton, soft coal passenger engine, so far as the boiler, frame and truck are concerned. It was built at the Hinkley Locomotive Works, Boston, and was finished in February of this year. Four cylinders are used, two upon either side of the engine; the dimensions of which are 10½″x24″. It will be observed from the engraving, Fig. 1, that the cylinders are placed side by side in the same plane; and the four cylinders being contained within two castings, do not increase the width of the engine as much as might at first be supposed.

It will also be observed that one valve admits steam to and from two cylinders, and is operated by the usual link motion, and rock arm, as is customary upon ordinary locomotives. There are serious objections to using two valves, from the fact that they would necessarily involve complication, and are more liable to derangement than one valve; whereas, with the present single valve, there is no back lash;

and if one valve is square, the other must necessarily be. The causes that affect one valve must affect both. This valve is represented in the engraving, Fig. 2. It is in form a plain **D** valve at one end, and a **B** valve, having a bridge at the other.

The upper engraving shows a section through *A B* of the lower engraving, which represents a plan of the valve and steam chest. The face of the valve is shown in the upper engraving, Fig. 3, while the middle figure shows a section through *C D*, and the lower figure a section through *E F*. From the foregoing, it will be seen that both cylinders take steam simultaneously at opposite ends. At *C D* the steam passes into the cylinder in the usual way; while at *E F* the steam passes under the edge of the valve, through the cavity and port into the cylinder. The reader can easily demonstrate the operation of this valve, by taking two strips of wood and laying out the ports upon them; then slide the strip representing the valve over the other, which represents the seat.

The valve is connected with a single valve stem, as shown in Fig. 2.

Before the valve was tried, it was argued by engineers that a valve constructed upon this principle would not work on account of the difference in friction upon the two ends, which would have a tendency to slew the valve out of a square position; also, that the pressure of steam upon the back would, of necessity, cause an excessive friction between the valve and seat.

These fears have proved to be groundless, as the valve works apparently with no more friction than the plain **D** valve upon locomotives. This we believe to be due chiefly to the steam passing under the valve at one end, as well as the pressure inside the valve, which would also have a tendency to reduce the friction.

We had the steam chest cover removed and examined the valve and seat, both of which were in excellent condition, there being no evidence of any twisting or cutting on the part of the valve.

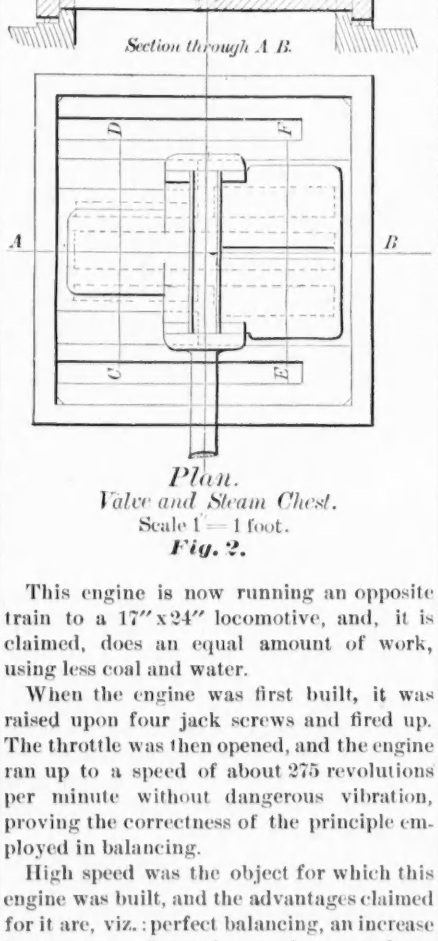
We are acquainted with an instance where a valve of this kind was used upon a 4″x 3½″ engine, constructed on the principle herein described, which ran about 800 revolutions per minute, attached direct to a fan blower; and it worked satisfactorily in every particular.

The same number of exhausts are heard from this engine as from the ordinary locomotive having only two cylinders, steam being taken and exhausted from the opposite ends of two cylinders, simultaneously. The driving wheels, which weigh 2,800 lbs. each, are accurately balanced, being cast with no counterbalance weights; but there are two crank pin bosses, placed opposite each other. One is intended for the crank pin, while the other is placed there for balancing. The arrangement of the cranks is shown in Fig. 4, where *A* represents a portion of the driving wheel; *B*, the crank pin; and *F*, the boss for balancing. The double crank is of wrought iron, and is in principle a rock arm, having a substantial center bearing, *D*. The cranks, as well as the pins *B* and *C*, are of equal size, so as to accurately balance each other. The box at *D* is made of composition, and is in two pieces, being divided vertically, in order that the lost motion may be taken up, as occasion may require. This box is held together by four bolts, and is adjusted by wedges placed in a pedestal jaw; the same as for the main driving boxes, only the parts are lighter. The pedestal jaws for the crank bearings are attached to a girder, *E*; the front end of which is bolted to the guide yoke, and the back end to the tail piece.

It is plain that, with the arrangement described, all or nearly all the power exerted upon the pistons is utilized to revolve the driving wheels, without moving them from their positions; whereas, with the ordinary locomotive, the full power exerted upon the piston is necessarily transmitted to the pedestal jaw, thereby causing undue friction, pounding, and a rapid destruction of the parts.

We rode about 35 miles upon the front end of the engine, shown upon the first page, and noticed that the usual swaying motion from side to side (as in ordinary locomotives when pulling a heavy train) did not appear. The train was composed of a baggage car, a smoker, and four passenger cars, all heavily loaded: yet, when the throttle was pulled wide open, with 130 lbs. of steam, the driving wheels did not slip, and the pilot did not swing perceptibly to one side or the other. When running fast there was no leaping or oscillating motion to the engine, which would indicate the revolutions; and they could only be counted by watching the rods or cross head. The usual long crank pin has been avoided by the device shown in Fig. 5, which represents the rods of the engine described. It will be noticed that the back end of the main rod is connected to a "spade handle," instead of directly to the crank pin; thus the customary rotary friction is changed to a short reciprocating rotary friction, which reduces the wear and tear, besides lessening the tendency to break the pin.

This engine has taken an express train, composed of five cars (viz.: two palace, two ordinary passenger, and one baggage), from Boston to Providence, a distance of 44½ miles, in 57 minutes, which is two minutes faster than schedule time, making no stops.



Plan.
Valve and Steam Chest.
Scale 1″ = 1 foot.
Fig. 2.

This engine is now running an opposite train to a 17″x24″ locomotive, and, it is claimed, does an equal amount of work, using less coal and water.

When the engine was first built, it was raised upon four jack screws and fired up. The throttle was then opened, and the engine ran up to a speed of about 275 revolutions per minute without dangerous vibration, proving the correctness of the principle employed in balancing.

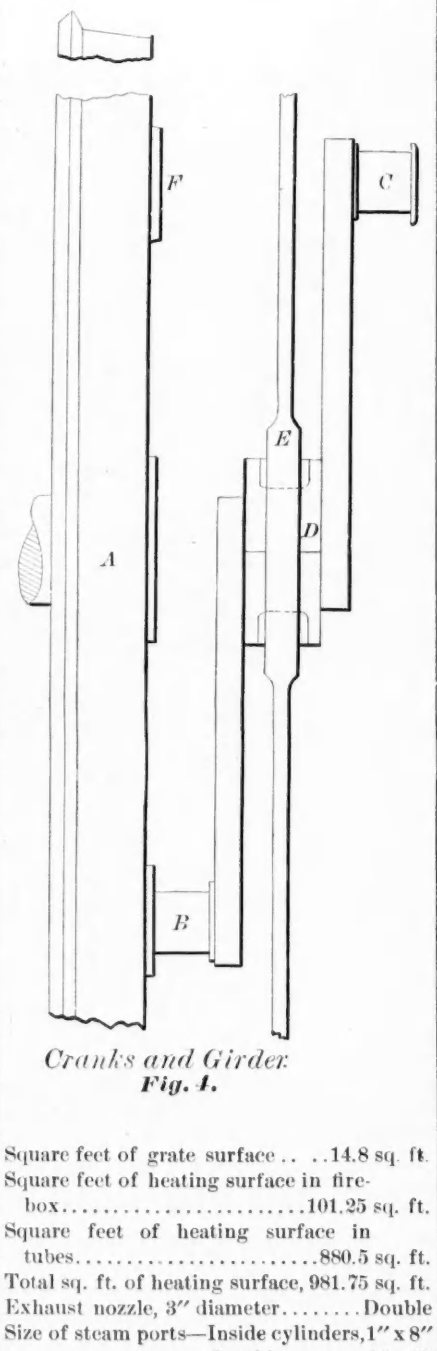
High speed was the object for which this engine was built, and the advantages claimed for it are, viz.: perfect balancing, an increase in the area of wearing surfaces, and, by dividing the work between four cylinders, a reduction in wear and tear is accomplished, and consequently less risk of accident.

It is also claimed that, by utilizing all the force developed upon the piston, directly upon the driving wheels to rotate them, the enormous loss through friction in ordinary locomotives is entirely avoided.

By the arrangement of the cranks offsets in the rods are avoided, and direct connections are made with both pistons. With a single crank without the center bearing, the torsional strain produced by one cylinder would necessarily be brought upon the crank-pin, and tend to loosen it. This would require the parts to be unusually heavy, besides offset rods or long crank-pins. A newspaper can easily be read by a passenger, there being less jerking of the train at high speed than with an ordinary locomotive. The engine now running is an experimental one, the advantages and disadvantages of which can only be determined by continued service.

The following are the principal dimensions and weights of the Shaw locomotive:

Total wheel base of engine and tender,	42 ft.
Total weight of engine in working order	74,300 lbs.
Total weight of engine and tender,	121,800 lbs.
Total weight of engine on driving-wheels	25,600 lbs.
Diameter of driving wheels	63″
" truck wheels	30″
" cylinders	10½″
Length of stroke	24″
Diameter of boiler outside smallest ring	48¾″
Number of tubes	161
Diameter of "	2″
Length of "	11 ft.
Length of fire-box	60″
Width of "	35⅝″
Height of "	66″



Cranks and Girder.
Fig. 4.

Square feet of grate surface	14.8 sq. ft.
Square feet of heating surface in fire-box	101.25 sq. ft.
Square feet of heating surface in tubes	880.5 sq. ft.
Total sq. ft. of heating surface,	981.75 sq. ft.
Exhaust nozzle, 3″ diameter	Double
Size of steam ports—Inside cylinders,	1″ x 8″
Outside "	2″ x 8″
Size of exhaust ports	2⅝″ x 17″
Throw of eccentric	5″
Travel of valve	4″
Outside lap of valve	¾″
Diameter of main axle journals	7″
Length of " "	7″
Diameter of engine truck journals	4½″
Length of truck journals	8″
Capacity of tank	2,000 gals.

In a recent conversation, Postmaster-General James is reported as saying: "The most valuable part of the New York Post Office is given up to architectural corridors, and we have to work by gaslight and electric lights even in the middle of the day. The same is the case in most of the buildings over the country, put up at a prodigious cost, and with a very slight inquiry into the necessities of the case." Not a few manufacturing establishments are open to the same objections.

Venting Green Sand Moulds.

By THOS. D. WEST.

Venting a mould with a vent wire is done to allow the free escape of air and gases in the sand, together with the steam generated by the liquid iron coming into contact with damp sand. New sand will not stand ramming as hard, and needs more venting than old sand, by reason of the additional life and gases in it. Sand mixed with sea coal or minerals needs still more venting because of the increased gases. Were it not to provide for the escape of these gases, air, and steam, moulds could be rammed as hard as iron, and have no blowing or scabs. The bottom part of a mould requires the most venting because it is the part which takes the longest time to be covered with a body of iron, and when covered is surrounded mostly by the iron.

Plain copes are vented more to allow for the easy escape of the air confined in the mould, than for the escape of gases or steam. Plain coped work, poured with hot iron, requires less venting than if it were poured with chill iron, as the hot iron has life enough to force the air up through the pores of the sand. If the iron were dull, the compressed air at some spots, not finding as ready relief, would hold back the iron, and by the time the pressure (or the air) escaped, the iron would be frozen, so that when the casting came out, it would show smooth, flat hollows in the cope part.

There is very little difference in venting plain copes for heavy or light casting, as regards the closeness of the vents. Light work should be vented to the surface of the mould, so as to allow the air to escape rapidly, while heavy work that requires a pressure of air to keep the cope from being drawn down, should be vented one to three inches from the surface. Copes having any pockets, flanges, or projections in them, require such places to be well vented. Moulds poured very fast require the same treatment.

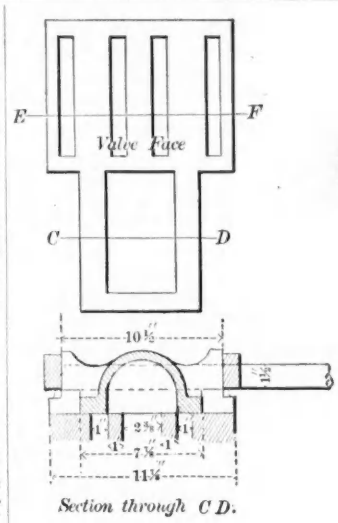
I shall never forget an incident that occurred in a shop where I was working, some sixteen years ago. It was before I had made up my mind to study cause and effect in foundry work. A moulder, doing some of the best work in the shop, was making a plain cylinder flatwise; it was about two feet in diameter by three feet long. He had a full split pattern with which to mould the outside; while for the inside the core was made on a wooden core barrel, full of small vent holes, with nails driven into it to hold the sand. The core barrel had iron trunnions on the ends, which rested on iron horses, extending out so as to hold the sweeping board. The sand was packed with the hands in the barrel, and the sweep made the required diameter. The first two or three castings that he made were lost, on account of the top portion of the core lifting up off the barrel. The man did everything he could think of to save them, using longer nails, making his sand tougher, and using very thick clay-wash. Above everything, he gave great attention to having the vent fired while pouring. In making the next casting, through some excitement, the vent was not fired until the mould was full. This casting, to the astonishment of us all, was a good casting. The cause of the previous trouble had been in firing the vent before the mould was full, causing an explosion which burst the core.

There are moulds that require a bed of cinders under them, and it is as essential to know at what time the vents should be fired as it is to know how to vent the mould. Take a mould having projections, green sand core, or any portion that the iron does not cover for some time when first going into the mould; and in such work the vent should be fired up at the top of the vent pipe as soon as you commence to pour. If you should light the vent at the bottom of the pipe, where it connects with the cinder bed, you are very apt to cause an explosion under the bottom of the mould, which will drive the air and foul gases up through the vent holes of the portion of the mould which is not covered with the rising iron, lifting or starting some of

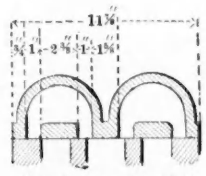
the sand and causing scabs, or, which is worse, blowing the mould to pieces. By lighting your vent at the top of the pipe, you draw the current of explosive gases away from the mould to the pure atmosphere, where they can burn freely. If you cannot draw the vent to the top, do not fire at the bottom until the mould is full. A good supply of vent wires of all sizes is something that every foundry should have, as their liberal use has saved many a casting that would otherwise have been lost through hard ramming, wet or inferior sand.

Cooling by Artificial Means.

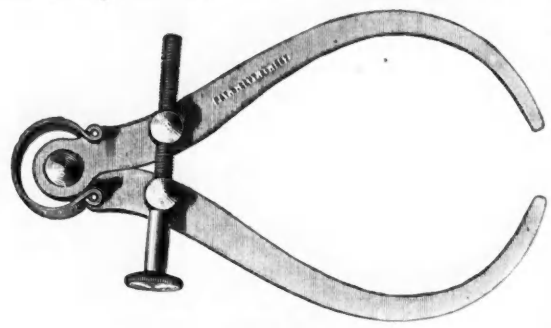
The subject of a paper recently considered by the Polytechnic Association of the American Institute was "Production of Cold by Artificial means." It was read by Mr. d'Heureuse. The first artificial cooling was, of course, that done by immersing the object to be cooled in water or putting it in contact with a cooler substance. Cooling by exposure to a current of air might have led to the use of evaporation of a volatile fluid as a means of reducing temperature. Cooling of water, by means of evaporation from the surface of a porous bottle, is traceable to remotest antiquity in hot and dry climates.



Section through C D.



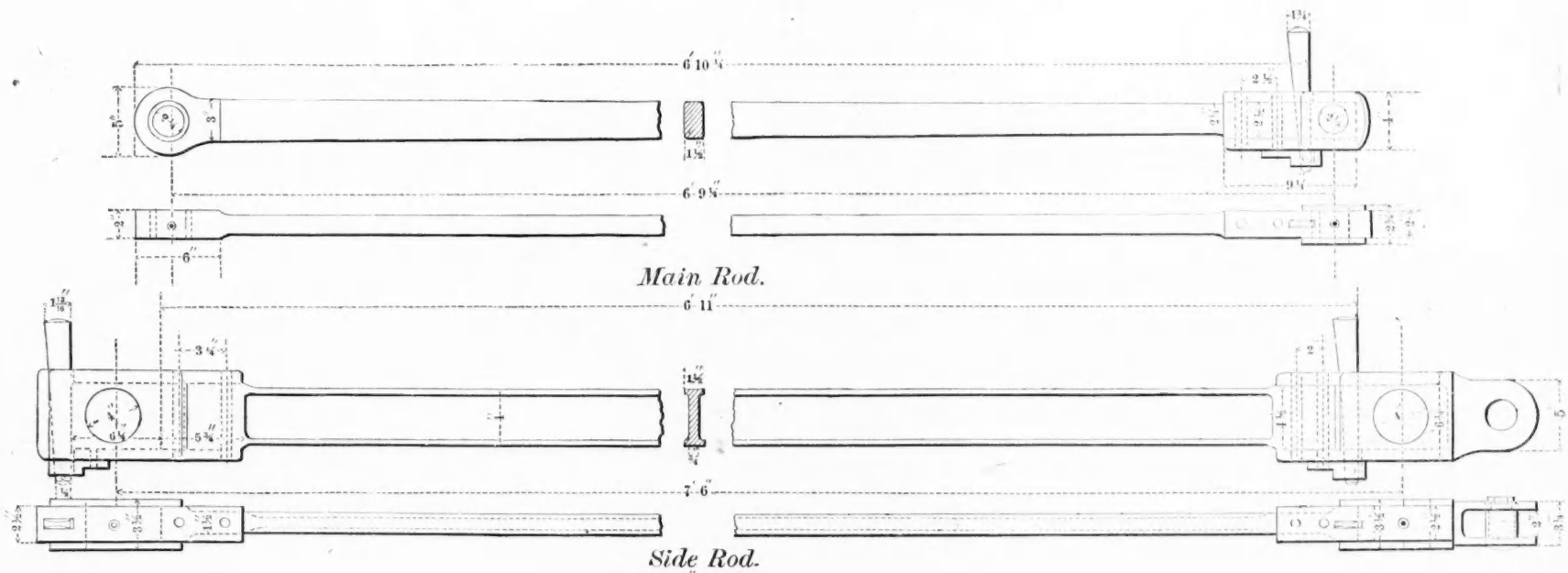
Section through E F.
Valve and Seat.
Scale 1" = 1 foot.
Fig. 3.



Machinists' Calipers.

The arms of the calipers shown in the accompanying engraving are made of flat steel and they are much stiffer than those in common use. This enables the user to more readily detect a variation in the size of a piece of work, as they will not spring over a piece that is too large. The reader will observe that the arms are held together by a rivet, and are opened by a spring which encircles the end, and is attached to pins upon either arm. With this arrangement the spring moves about one-half the distance—in opening the calipers a given distance—that it would if it were made solid with the arms; therefore it does not lose its power, and the resistance of the spring is sufficient to hold the arms firmly apart when set to any size within the limit of the calipers. Should the spring become broken it can be easily replaced, as they are made interchangeable. The arms are adjusted by a screw having a milled head, and passing through a stud in each arm, one of which is threaded to receive the screw, after passing through a larger hole in the other, which the spring presses against a shoulder on the screw. There is no danger of the size being changed when the caliper is laid down, as the head of the screw, being round, is not as easily moved by accident as a thumb nut.

These calipers are manufactured by Edward Wright & Co., Worcester, Mass.



Scale 1" = 1 foot.
Fig. 5.

Artificial cooling is invariably produced by the removal of the heat from one body and its transferrence to another, by which it may be carried off. The volatile liquids, or those which evaporate rapidly at ordinary temperatures, can be made to take up a great amount of heat. Among those which are used for the production of cold are alcohol, sulphuric ether, gasoline, ammonia, methylic ether, anhydrous sulphurous oxide, &c. The fact that air absorbs heat in expanding has led to its use as a means for producing cold artificially.

Ice, in melting, absorbs a very considerable amount of heat—some 174 heat units. Freezing mixtures, so called, have been in use for hundreds of years, and are very useful. The most common is that of snow or ice and common salt. Nitrate of ammonia (sal-ammoniac) and water comes next. In addition, a long list of mixtures was given by which great cold could be produced.

Beer brewing has made the matter of cooling one of much importance, and has given a great stimulus to inventors. The preservation of animal and vegetable productions, and their transportation by rail and ship, have taxed the ingenuity of inventors to the utmost.

In general, when a volatile substance is used, it is allowed to evaporate, during which time it absorbs heat very rapidly. The gas resulting is then condensed by a pump till it returns to a liquid form. The heat which results must be taken away, and for its conveyance a large quantity of water must be used.

In answer to questions, the speaker said that we have no other way of getting rid of the heat but by the use of water.

The ammonia ice machines labor under very serious disadvantages; they are subjected to high pressures and the ammonia attacks the lubricating materials forming a soapy compound, while its constant presence about the machines is disagreeable and injurious at the same time. Sulphurous acid machines work under a pressure of only 40 pounds, but they are much larger than the ammonia machines. Ether, gasoline and the petroleum compounds are very inflammable and dangerous, while the latter are also unstable in composition and in use gradually grow less volatile.

There is now a demand for some apparatus which can be used on shipboard which will cool large apartments, and so enable meat to be transported from Australia or America to England, fresh. Recently it was stated that cargoes had been successfully landed in England from Australia.

The system employed in the breweries is to build a large room capable of holding from 20,000 to 30,000 tons of ice and place below this the beer to be cooled. The air cooled by the ice falls to the bottom of the lower room, while the air heated by the wort goes up among the ice above. The cost of storage, handling and wasting is enormous. If machines can be used, both the space and expense can be reduced. Much ice is also used in swimmers in the beer.

A bill providing for a State system of steam-boiler inspection passed one branch of the Illinois Legislature, but failed to pass the other.

U. S. Minister Andrew D. White, at Berlin, has recently given the State Department some special information regarding a royal decree establishing an "economic council" for Germany. This decree creates a council of experts who possess special technical knowledge, who are free from party ties, and whose opinions should carry more weight in the industrial and commercial affairs of the country than those of any mere members of the Prussian legislature. To this council are to be submitted bills affecting commerce, manufactures and agriculture. It is composed of seventy-five members, called together for a season of five years. Forty-five are selected by the ministers of trade and commerce, public works and agriculture from among ninety persons, nominated by the various chambers of commerce, manufacturing industry and agriculture, throughout Prussia. Of the forty-five, fifteen represent commerce, fifteen manufactures, and fifteen agriculture and forestry. The other thirty are freely selected by the above named ministers, with the special provision that fifteen of them must be taken from among working men. The council has already been organized, and has passed upon some important public measures.

The World's Fair sign on the outer wall at 317 Broadway has been taken down, and the big room that was occupied by the Executive Committee has been rented for business purposes. The small inner office is still occupied by the Commission, but an office in another building will soon be obtained. There is no truth in the rumor that there is to be a formal announcement within ten days that the required money for the Fair will be forthcoming.—*New York Sun.*

At noon on the 1st inst., a boiler exploded in Gaffney & Co.'s dye works, Philadelphia, instantly killing three men and injuring eight other persons, besides doing considerable pecuniary damage. The dye works were totally destroyed. The boiler (or a part of it) was blown over 400 yards, forcing its way through the back brick wall, through two fences, knocking down posts, and landing in the railroad depot yard in front of the works.

There was no engineer on the premises. A fireman was in charge when the accident happened. The front head of the boiler gave way. It was shown that when the explosion took place the injector was at work feeding the boiler.

The new transfer steamer Northern Pacific, No. 2, belonging to the Northern Pacific Railroad Company, recently completed in St. Louis, made a trial trip last week, the performance being to the entire satisfaction of all concerned. This is said to be the only existing stern-wheel railroad transfer steamer. The hull was built at Mound City by W. L. Hambleton; engines at the Fulton Iron Works, and the steel boilers by Joseph F. Wangler, of St. Louis. She has already left for the Yellowstone river, where she is to be employed in the service of the Northern Pacific Company.

The Plymouth Foundry Company, Plymouth, Mass., have organized by the choice of the following officers: William H. Nelson, Wm. R. Drew, James Millar, Thomas E. Cornish, Charles B. Stoddard and Geo. F. Weston, directors; Matthias Pratt, treasurer; Arthur Lord, clerk. The directors were authorized to purchase the property of the Plymouth Iron Foundry Corporation, at a sum not to exceed $15,000. The foundry will begin operations as soon as the necessary preliminaries are settled,

New Gun Milling Machine.

The accompanying engraving represents a new style of gun-milling machine. It is mounted upon a substantial hollow cast iron base, which also answers the purpose of a tool closet. The head, which carries the spindle for the cutter, is gibbed firmly to an upright, and may be fed up and down by hand while the machine is in motion. A gauge screw is provided, by means of which any number of pieces of work may be milled to a uniform and accurate thickness. The table is very strong, and is arranged so as to present true planed surfaces upon which to fasten the work.

These surfaces are prevented from springing by the substantial construction of the bed. The feed motion is conveniently arranged by an ingenious automatic arrangement, which also greatly facilitates the work. The spindle is strongly geared, and the machine, as a whole, is well designed. There are two sizes of these machines built at present—No. 1 being intended for sewing machine factories and armories. No. 2 is adapted for use in railroad shops, electric light factories, or where heavy work is to be done, it being very strong.

Great care is exercised in finishing the bearing surfaces, they being all scraped by hand to true bearings. No emery is used in any of these processes for grinding parts to fit. These machines are built by the Newton Machine Tool Works, 2,341 and 2,343 Callowhill street, Philadelphia, Penn.

Machine Architecture.

BY F. F. HEMENWAY.

When an individual contracts for a machine of any sort, to be of ample strength and of good design, material, workmanship, &c., and gets something so outrageously homely as to suggest three or four kinds of nightmare, has he any recourse, or is he obliged to take it and set it up and use it to the everlasting detriment of his peace of mind? Can he, notwithstanding it fills the terms of the contract so far as material and workmanship are concerned, and notwithstanding it performs its duty in a manner that won't admit of criticism, refuse to receive it on the ground of its being a nuisance?

What I want to know is if there is any law that applies to machine architecture; or if there is any custom that takes the place of law, and that can be used to the restraining of a man from selling you something you don't buy? I don't know much about "structural beauty," but I have read something of the different orders of architecture, and have a right to dislike seeing them mixed, and perverted to uses they were never intended to serve. It isn't anyone's business that I couldn't improve on the design, or suggest a way to do so. I have a right to want to buy good-looking things, if I don't know the first principle of their design, and couldn't begin to tell what makes them look well.

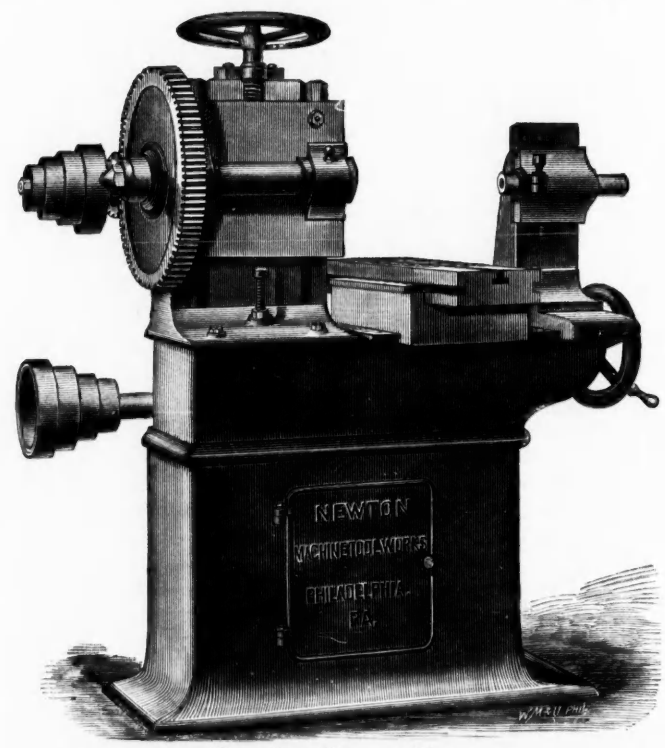
If a man accepts the machine, and it works correctly, and he studies the design, and it dawns on him that the strains and shocks and blows are met by the right disposition of metal, will its humps and projections begin to look beautiful to him? I don't believe they will—not altogether. He will always sigh for the artistic relief of things that look unsightly in their bare utility. Something that don't cost much—don't add to the practical utility of the machine, and yet increases its real value—to him; something to which he can't affix a dollar and cent value; something which is valuable because he can't value it.

If, instead of buying that machine, it had been of his own creation—if he had sat up nights in its conception, and worn out rule and practice in getting things to *resist* and *do*, I am inclined to think it would have looked beautiful from the beginning. If he had sat down and paternally watched its operations and found them "perfect," its very ugliness would assume fair proportions. All this while he would forget that his machine was designed for other people's criticism.

If, after he had completed his design so far as its functions as a machine were concerned, he had added a little in the way of embellishment, it might have looked better to him. It is reasonably certain it would have looked better and *sold* better to the average buyer.

When a man builds a house he invests a little money to make it comfortable, and considerable to make it beautiful. It assumes proportions that were never suggested by any question of utility. When he furnishes it his tastes lean towards the artistic. He devotes a little to utility and more to adornment. He does this because he likes to look at beautiful things. Such things make all who come in contact with them happier and better. The quality of beauty takes upon itself a new function—that of utility. I haven't any faith in the argument of those useful individuals who claim that the whole aim and purpose in a machine design is concluded by its ability to bring about certain effects on inert matter. It ought to do something for the mind of the beholder. Some strict utilitarians object to paint on cast iron, as serving, in many instances, no useful purpose.

Imagine a neat clean shop, filled with



NEW GUN MILLING MACHINE.

well-designed machinery with the foundry looking fresh on the unwrought parts. Imagine it, for you never will see it in any other way. That foundry look will be veiled under a quarter of an inch of dirt and grease, and there isn't a ghost of a chance for the shop to look neat or clean.

No man can ever be coerced into keeping an unpainted or unfinished piece of machinery clean, and its very dirtiness will inoculate the individual whose duty brings him in contact with it. It will darken the windows, smoke up the walls, break down other things, and break down itself. I am of the opinion that a neatly designed, neatly finished and painted machine has a good moral effect on the man who has much to do with it. It is order, and system and neatness itself, and it suggests the practice of those virtues to the beholder. Physical order, and system and neatness has a close connection with moral order, and system and neatness. It is astonishing how much the observer finds in common in the material condition of men and their daily surroundings. It is more astonishing to what an extent his moral nature gets into sympathy with both.

I know a prominent steam-engine builder whose engines are models of taste in design, in paint and in finish. Their contemplation has improved the material and moral tastes of a good many individuals. They are good as a machine, excellent as an educator, and peculiarly an element of safety. You can't get such a steam engine into affinity with flanges and monkey wrenches on safety-valve levers. The contrast is too great between them and leaky, disorganized, dirty boilers. You can't get along without an approximation to correspondence in such things.

Certain conditions of mechanical appliances demand certain conditions of correlative appliances. Such an engine will educate an engineer up to care and reliability, or it will educate a proprietor up to dispensing with his services. I don't exactly say that such a machine *won't* run under conditions of dirt and grease and leaky boilers. I only say they *don't*.

If I were buying machinery to locate in dark, ill-kept, ill-ventilated places, I wouldn't go very extensively for looks. I would buy machinery that would get right into sympathy with the surroundings, and hire workmen that represented similar conditions. It wouldn't matter so much about the human part of the plant. That would get down to the proper grade without material loss of time. I wouldn't allow of any expense in the way of artistic arrangements, and wouldn't invest a cent in paint, finish or waste. There ought to be a correspondence in all things.

If I were buying machinery for light, well-arranged, and well-ventilated rooms, I should want to preserve the correspondence. I should want it well designed, and would stand a few dollars in the way of paint and finish. I should want workmen who were in sympathy to the end, that the result might be harmony.

I won't say I don't know as all this will pay, because I do know it will pay. When I buy my machinery I want it to look well from an engineer's point of view, and I want it to look well from an artist's point of view. When the engineer has exhausted his skill as an engineer I want him to draw on his skill as an artist. If he don't combine the skill of both it is all right. Perhaps it is all the better. He can patronize the skill of the artist to adorn and embellish his designs.

The chief difficulty is that the artist is usually first employed. You can't satisfactorily utilize adornments. You can adorn utilities without much trouble. I expect to pay for the engineer's creation of strength, and stability and economy, and generally correct proportions. I am willing to pay for the artistic creation of beauty. I don't want to see correctly-turned shafts projecting through properly fitted boxes, and standing out in all the primitive originality of the blacksmith's shop. I want to pay for rounding and polishing the ends. I don't want to see pulleys and wheels wobbling around in a generally uncertain manner; nor foundry sand and sprues either in their original unsightliness, or after a futile attempt at concealment under paint and putty, not if it can be demonstrated that their aggregation is all right as a machine. It must be all right as a machine without these hereditaments.

When a man is to pass the best part of his time amongst his machines and machinery, he ought to arrange to get work and instruction therefrom—pleasure and profit should both result. If there is any reason why he should own a good-looking horse, or invest ten cents in blacking his boots, and the same reason won't apply to his steam engine, or his line shaft, or any of his mechanical appliances, I am anxious to learn why.

LETTERS FROM PRACTICAL MEN.

Essentials for Mechanical Drawings.

Editor American Machinist:

Your remarks lately about the literature of the drawing table having yet to be created are pointed, and I think that the good work begun in the AMERICAN MACHINIST should be carried on in the further ventilation of ideas on the subject. The efficient and rapid draughtsman is worth more than money to his employer, because he saves money in devising the best possible means to serve a purpose with the least labor and expense in carrying it out. That there are many draughtsmen who have no idea of a standard of excellence in their profession, is beyond a doubt; and there is, perhaps, more of a variety in draughtsmen, both in style and in their opinions and drawings, than in those who carry them out; and a very few are the combination in themselves of every good quality.

Skill in design is of first importance, although often the possessor of it is more accustomed to the material than to representing it on paper; while another fellow, who is good at shading and fancy lettering, does his thinking and designing on the paper only, and his drawings may look better, but be of defective design and more expensive to carry out than the other.

Now, the business of our lives is to think and think hard, and the proper man ought to think in the material he is working upon; and, in order to represent his ideas effectively, should have artistic taste—not to make a picture of it—but to legibly and intelligently present the subject to the workman in a drawing which has neither too much nor too little shown upon it, but enough to give him all the information he is likely to want in constructing it, and to supply which, plenty of notes and explanations should be put on where necessary, after Chordal's schoolboy fashion.

Next in importance to skill in design is rapidity of execution, the ability to produce a maximum of effect with a minimum of time and labor. Some draughtsmen deem it indispensable to devote a certain number of days to a piece of work, in order that it may have a creditable appearance; whereas it might be done in as many hours. Especially is this true in regard to headings and titles on drawings. All office drawings, of which working copies are made, should have sufficient information on them to let the man that looks at them ten years hence, know what they are, and what they belong to, and when made and used, and all about them. Now it would be folly to spend several hours in fancy lettering on a working drawing, when the same could be brushed in neatly and effectively in several minutes; but for want of this ability, the drawing frequently goes without.

I don't agree with "Quirk" that the scale should not be named on mechanical drawings; but to obviate errors in scale measurements, by the workman, it should be judiciously figured; to which the scale should at all times agree. In a recent publication, we are told that "figured dimensions are productive of carelessness in the workman; that he should trust to his own measurements, as taken from the drawing, holding him responsible for the accuracy of those measurements; the draughtsman, on the other hand, responsible for the accuracy of the drawings." Now, this is the other extreme. The draughtsman is more competent to measure his drawing than the pat-

tern maker or machinist; and should do so, and mark it on for their benefit.

Montreal, P. Q. STRAIGHT EDGE.

Arcs and Chords.

Editor American Machinist:

Referring to the letter on "Pitch Circles of Gears" on page 6 of your issue of June 4:

The pitch is an arc of a circle. Let two pitch circles, having diameters of 7.64 and 30.56 inches, be divided for 12 and 48 teeth respectively. The pitch will be two inches in each case; and, if the circles be rolled together, the points of division will successively meet at the point of contact, showing the equality of the pitch.

But the *chord*, represented by the dividers in marking the points of division, is less than the pitch. And their difference diminishes as the diameter of the circle increases, until, in a rack, both arc and chord disappear, and we have a straight line divided into parts, each two inches long. *Now* the dividers subtend the true pitch, and the points of division of either of the circles will successively meet those of the straight line when rolled upon it.

A rule, to give the length of chord (or opening of dividers) for any case, would be somewhat complicated. A table of polygons up to, say, 300 sides, giving the ratio between the diameter of circumscribing circle (representing the pitch circle) and the side (representing the chord of the pitch arc), would simplify the matter somewhat. The writer saw such a table, in manuscript, many years ago. Similar ones may exist in print. But neither table nor rule would be used to any extent. A circle of the proper diameter, divided into the required number of parts, covers the entire ground, and would generally be produced more simply and readily without them than with them.

A. B. COUCH.

Philadelphia, Pa.

Technicalities in Working Drawings.

Editor American Machinist:

It seems to me that certain technicalities in working drawings are labor-saving and time-saving in the end. The signs + and — are arbitrary technicalities, but a teacher cannot be expected to always write plus and minus, just to save the student the trouble of learning the symbols.

I have found the following rules very convenient, and never knew drawings made by them to mislead the workman:

1. Make drawings full size if possible, and use shrink rule for pattern drawings, in order that the pattern maker may trace irregular forms directly from the drawing.

2. Shade all round parts with the brush. Tint sections and hatch with point of brush. If different tints are used for different materials, show in margin what they mean.

3. Draw center lines in red, and show finish to be added by blue lines.

4. Put in all important dimensions and all suggestions or alterations in red ink.

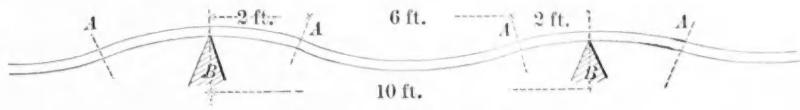
Orono, Me. C. H. B.

Line Shafts and Couplings.

Editor American Machinist:

The correspondence in your columns relating to shaft couplings is suggestive of the fact that the average coupling is a frequent source of trouble. Buildings or roofs are not always as rigid as they should be to properly sustain a line of shafting, and when the alignment is seriously deranged, the life of the best couplings, or of the key-seated ends of the shaft will be short. The functions of the coupling are threefold. 1. To transmit properly torsional strain. 2. To resist the tendency of the shaft to separate lengthways. 3. To be capable of ready removal and replacing. In my experience the failure of couplings to hold shafting together longitudinally is the most frequent cause of trouble.

The position of the couplings on a line of shafting is of considerable importance, and it is not an infrequent error that the couplings are kept too close to the bearings. When the distance between bearings is excessive, and the couplings are close to the bearings, the tendency of the shaft to pull out of the couplings is noticeable, and sometimes difficult to correct. When a shaft is continuous over several bearings, and presuming that the bending load is evenly distributed, the bending strains, and consequently the resulting longitudinal strains, are greatest at the bearings, being at this point double what they are at a point midway between bearings, and the bending strains are least at the points of contrary flexure, which points, in this case, will be at a distance from either bearing slightly over one-fifth of the distance between bearings. Thus, if a continuous shaft has its bearings ten feet apart, the couplings ought to be two feet from the bearing. The reasons for this can be seen by examining the diagram representing a shaft,



supposed to be deflected by the action of its bending load. *B B* are the bearings, and *A A* the points where the curves of deflection reverse, and where the bending and longitudinal strains are least, and hence the proper points to locate couplings.

As pertinent to this subject, the writer offers the following arithmetical formulas for the diameters and the distances between bearings of line shafting of wrought iron, premising that every special case requires its own proper determination, the rules being empirical, but believed to be sustained by correct practice, in average shop and mill work.

For shafting carrying ordinary belting and pulleys

$$\frac{80 \text{ H.P.}}{\text{R}} = \text{cube of diameter of shaft in inches.}$$

$\sqrt{\text{diam. of shaft in inches}} \times 6\frac{1}{2} =$ greatest distance between bearings in feet.

When the shafting merely transmits power carrying no pulleys

$$\frac{60 \text{ H.P.}}{\text{R}} = \text{cube of diameter in inches.}$$

$\sqrt{\text{diam. of shaft in inches}} \times 10 =$ greatest distance between bearings in feet.

H.P. = horse power transmitted.

R. = revolutions of shaft per minute,

These rules do not apply to the head shaft, where the power is first received.

Pencoyd, Pa. J. C.

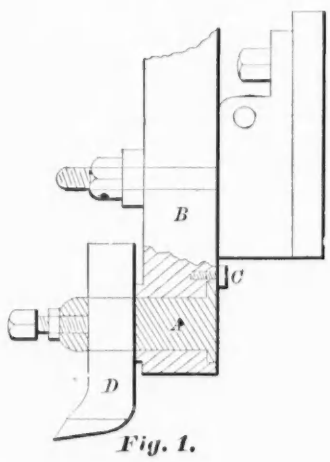


Fig. 1.

A Convenient Tool—Chordal's Bolt Drawing.

Editor American Machinist:

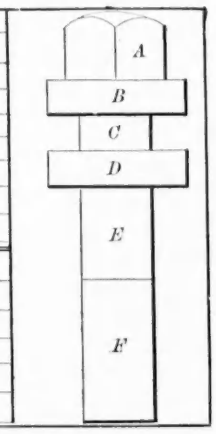
The accompanying sketch shows a very convenient tool for lathes but more especially for planers. It consists of a piece of iron (Fig. B) 2″ by 1½″ forged as shown in (Fig. 3). It is then drilled and recessed and fitted into a tool post (*a*) having a slot cut through it to receive a tool (D). The small screw (*c*) is to prevent the tool post from slipping back, yet at the same time allow it to move freely in the hole. For ordinary work the tool may be used as shown in (Fig. 1). For facing the sides of work the tool (D) is set at right angles with the bar of iron (B.) For work requiring the "broad nose" tool it is used as shown in Fig. 2 which prevents the tool from "chattering." It is also an excellent tool for cutting key-ways, as the tendency is to spring away from and not into the work, and prevents "gouging." Fig. 3 is a rear end view of the tool. The advantages of this tool are: first it makes a stiffer tool when used a great distance from the cross head; secondly it makes the best tool for facing down the sides; thirdly it saves steel which is quite an item in large manfacturing shops where a variety of tools are needed. This tool has been in use for a year or more in the shop in which the writer is employed, with success; and as there is no patent on it, no royalty will be charged for its use.

A word about Chordal's bolt. I like the "school-boy" drawing of chordal with the exception that it does not show the distance between collars, etc., and the head of his bolt does not look either square or hexagon. It is not complete in that it compels the machinist to measure the width of collars, etc., and it is just as easy to measure diameters and squares as to measure widths and lengths. What we want for the machine shop is a drawing to give the machinist an idea as to the *shape* of the work, not leaving any room for the excuse "that the drawing measures so." All dimensions should be marked on the paper not on the drawing *itself* (as I have in the illustration shown, which needs no explanation, neither does the lathe or shaper hand need inquire which part of the work is for him to do). It will make a little more work for the draughtsman, which will be amply repaid by the time gained in the machine shop.

Waynesboro, Pa.,

YOUNG AMERICA.

		Dia.	Length	Width
LATHE WORK	A	17/32″	3/8″	
	B	3/4″	3/16″	
	C	3/8″	3/16″	
	D	3/4″	3/16″	
	E	17/32″	1/2″	
	F	3/8″	3/4″	
SHAPER WORK	A		3/8″	3/8″
	E		1/4″	3/8″



BOLT DRAWING, WITH SPECIFICATIONS.

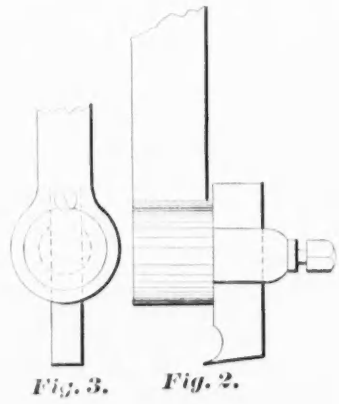


Fig. 3. *Fig. 2.*

The Mississippi Engine Again.

Editor American Machinist:

The principal peculiarities of this steam engine, so far as the details of movements are concerned, lie in the valve motion, and the pumping mechanism.

I do not know at what time the D or common slide valve made its appearance on western waters; indeed I do not remember now to have ever seen a detailed drawing of the "Clermont's" engine; but I presume the "Clermont" used poppets and I think the first western boats were all fitted with that most excellent style of valve.

The details of the valve motion consisted of a pair of cams on the main shaft running in square frames (not grooves, as the printer made me say in last article), which frames had a slide projecting outwardly from the middle of each side; these slides ran in stationary guides, and limited the cam frames to a horizontal reciprocating movement, which was transferred through immensely long rods, supported by several sets of guides, to rockers over the cylinders; the reverse was effected by hooking the cam rods on wrists on opposite sides of the rocker centers, and toes on the rocker shafts lifted the valve bars, which with the old unbalanced poppet valve dropped with great certainty and promptness, as they had the full steam pressure due to the diameter of opening upon them when closing.

In the cases where the D valve was used it was often, if not always, set perfectly square, with neither lap nor lead, and consequently the distribution of steam was just as good hooked on the top wrist as on the bottom or "go-ahead" end.

The throttle was invariably made with an outside screw and hand wheel; and the valve and valve stem were usually solid, with the screw cut on the valve stem, and running in a nut supported in a cross bar elevated on two standards to a good height above the valve cover. This arrangement made it necessary to turn the valve on its seat when commencing to admit steam, and with a valve of, say, even 4″ or5″diameter this took considerable muscle.

Very large and heavy hand wheels were used on top of the throttle valve stems, and these were arranged to "flirt," that is there was a quarter of a turn slack in the key way, so that the hand wheel turned freely for 90° without influencing the valve stem at all. Of course when one of these hand wheels weighing 25 lbs. to 75 lbs. got a lively "twitch" from a muscular "striker" it transferred a considerable increment of kinetic energy to the valve stem when the side of the key-way came up against the key and "humped the cover off the steam hole" right lively.

There is a difference between the slang of the modern high-toned "mechanical engineer" and that of the old-style fellows; but nobody's nickel-plated, million-jointed, balanced-on-its-eyebrow valve motion ever got an ounce more of "potential energy" out of a pound of coal than Jamie Watts' engines found and used, although I very much incline to believe that Mr. Murdoch would have thought "kinetic energy" was some mortal insult had any one used the expression to him.

The variable vertical alignment of the river engine led to some curious expedients in the way of stuffing boxes.

Take a small pair of engines, say 10″ bore x 72″ stroke, and put 18″ clear between the cylinder head and the back end of the long U cross head, and there would be about 14 or 15 feet between the back cylinder head and the front end of the slides; and it was just as likely as not that, at same time when the pilot, and the "old man," and the engineer, were all very anxious to have the wheel turn, and "turn stout" too, there would be a bend of two inches in this distance on the pine engine timbers; and even if the piston rod would follow the curve without cutting the rod (which was very doubtful), there would be such an enormous friction as to leave a very unsatisfactory percentage of the foot-pounds on the piston to transfer to the crank pin. This possible condition led to the employment of a neat and efficient

device, as simple as it was novel. The stuffing box bolts were very long, say 12″ clear; the follower short, and the stuffing box in the cylinder head very large. The hole in the head through which the piston rod passes, which in ordinary work is just a nice sliding fit on the rod, was cast, say, an inch large, giving ½″ clearance on a side. A substantial brass plate, an inch less in diameter than the stuffing box, is fitted to slide on the piston top, and to lie in the bottom of the stuffing box. Next comes the packing, cotton cord, ½″ or more in diameter, white as snow, and wound neatly on the piston rod far outside of the stuffing box, and this packing is not cut off from the coil at all. It is just carried up to a reel mounted on a stud in a convenient place above the timbers, so that at any landing where the engineer has a little time a few turns can be added to that on the rod. The follower, or "gland," as the piece is now commonly called in the East, is kept well out to the end of the bolts, and the whole thing will lift up or down half an inch in the cylinder head, and "never turn a hair."

All of the castings for the engine are very simple. The cylinder is cast with substantial lugs along the sides, near the middle line, and has a nozzle at each end to take the side pipes. These are separate castings (made sometimes in two, sometimes in four pieces), and are simple jobs of cored work, rectangular in section, and having only one carve at each end

A common old-fashioned way to run the pumps was to bolt a pair of **A** frames to the timbers about one-half stroke of the engine in front of the guides, and mount a **T** armed rock shaft in the top of the frames. A light connection from the cross head took hold of the bottom of the vertical arm, and the two vertical pumps were operated from the two ends of the horizontal arms of the **T** rocker.

On large boats, a separate beam engine, located just aft the boilers, and called the "Doctor," is employed to run all the pumps needed for various purposes, including boiler feeding, and there is also a "nigger" engine aboard the larger boats for handling freight.

The "Doctor" is often a very peculiar machine in construction. I remember one which was built by a prominent St. Louis firm some 25 years since, and had a lot of bolts so admirably located that it took a cold chisel two feet long, with two crooks in it, to turn the nuts at all; but then "you can set a nut up with a cold chisel and hammer tighter than any other living way you know," so these "doctors" were very popular, and went upon lots of good boats.

EASY WAY.

Fast Melting of Iron.

Editor American Machinist:

I saw in your valuable paper, last winter, an account of a heat melted in a foundry cupola, by Geo. M. Holmes, of Gardner, Me., in which he gave a very full description of the working of a cupola, and the results obtained, which were very good. I give herewith an account of two heats, which were melted under my directions a short time ago. I do not make a business of melting iron, or building cupolas, but this cupola had been built from ideas taken from my work, the "Founding of Metals," and did not produce the results claimed for t. To demonstrate that the trouble was inot in the construction of the cupola, but in the running of it, I had to take charge of it, and run it a day or two.

This cupola had never melted more than four or five tons per hour, and the object in running these two heats was to obtain fast melting. The coal used was all small, and broken, and the time of melting was from the time the blast was put on, until it was taken off. I will give a full description of the cupola, which may be of interest to those of your readers who are contemplating the building of new cupolas, and a description of the mode of charging it, which may assist those that are troubled with slow melting.

The shell of cupola was 72 inches diameter, and 17 feet high from iron bottom; tapper from cupola shell to stack 6 feet long, and reducing from 72-inch shell to 40-inch stack; entire height of cupola and stack, 60 feet; height from iron bottom to top of tuyeres, 13½ inches; height from iron bottom to bottom of charging door, 13½ feet; size of charging door, 30x36 inches (double door); belt air chamber on outside of cupola, 10x12 inches; air chamber supplied with blast from two 10-inch, and one 13-inch branch pipe, from a main pipe 24 inches diameter, and a No. 9 blower; lining of cupola, 9 inches; lining of stack, 4 inches; diameter of cupola inside of lining, 54 inches; size of tuyeres, 12x2½ inches, laid flat; height of bottom of tuyeres from sand bottom, 7½ inches; number of tuyeres, 8.

The following heat was melted in the foundry of the Rhode Island Locomotive Works, Providence, R. I., April 26, 1881.

	Coal used. lbs.	Iron melted. lbs.
Coal for bed.....	1656	
1st iron on bed.....		4000
2d charge coal...	400	
2d charge iron		4000
3d charge coal	450	
3d charge iron.....		4000
4th charge coal.....	450	
4th charge iron.....		4000
5th charge coal..... ..	450	
5th charge iron.....		4000
6th charge coal...	450	
6th charge iron.....		4000
7th charge coal.....	450	
7th charge iron.....		4000
8th charge coal.....	450	
8th charge iron.....		4000
9th charge coal.....	450	
9th charge iron.....		4000
	5,206	36,000

This heat was melted in two hours and forty minutes, 6 $\frac{9}{10}$ lbs. of iron being melted with each pound of coal used, and 225 lbs. of iron per minute from the time the blast was put on until taken off.

The following heat was melted in the foundry of the Rhode Island Locomotive Works, April 27th, 1881.

	Coal used. lbs.	Iron melted lbs.
Coal for bed.....	1840	
1st iron on bed.....		4000
2d charge coal.....	400	
2d charge iron.....		4000
3d charge coal.....	400	
3d charge iron.....		4000
4th charge coal.....	400	
4th charge iron.....		4000
5th charge coal.....	400	
5th charge iron.....		4000
6th charge coal.....	400	
6th charge iron.....		4000
7th charge coal.....	400	
7th charge iron.....		4000
8th charge coal.....	400	
8th charge iron.....		4000
9th charge coal.....	400	
9th charge iron.....		4000
10th charge coal.....	200	
		2000
	5,240	38,000

This latter heat was melted in two hours and forty minutes, 7¼ lbs. of iron being melted with each pound of coal used, and 237½ lbs. of iron melted per minute from the time blast was put on until taken off. The iron was hot enough for stove plate all through the heat. These two heats were experimental, with a view of doing fast melting, and the capacity of the cupola was increased from five tons to over 7 tons per hour.

EDWARD KIRK.

Oswego, N. Y.

Friction Contact and Power of Belts.

Editor American Machinist:

It is interesting to compare Mr. Webber's experimental results on the friction of belts having various arcs of contact, as given in your issue of May 21st, with those determined by the accepted theory of belts. This I have done in the table below. In computing this table, the coefficient of friction was first determined from Mr. Webber's results for the angles, 90°, 180° and 270° The average of these results was then taken as the true value. This coefficient was then substituted in the usual formula for the friction of belts, and the equation solved for the angles given by Mr. Webber. In the first line of the following table Mr. Webber's results are recapitulated; in the second, the results obtained as above are given, and in the third will be found the results obtained by assuming the friction to be simply proportional to the arc of contact. These computations were made from the experiments with the 36-inch pulley—those being most complete.

Arc of contact.	90°	130°	180°	220°	270°
Weight on slack side.	45.20	43.75	43.80	43.95	40.56
W't held by experiment..	22.70	30.45	43.10	59.50	96.81
" " " rec'd theory..	21.26	32.59	50.89	68.82	88.38
" " " proportion ...	22.70	31.74	44.00	53.95	61.11

It should be remarked that the coefficient of friction deduced from these experiments is unusually small. Its value is .245. The standard experiments of Messrs. Briggs and Towne gave .583. In their paper it is stated that the previous experiments of General Morin gave .573. Neither do these experiments bear out Mr. Webber's practical rule for proportioning belts—"600 feet velocity per one inch of belt width per horse power." (See his manual of Power, page 96.) Taking Mr. Webber's results for an arc of contact of 180°, a simple computation shows that to transmit power with this allowance of belting would require a strain of 111 pounds per inch width of belt—entirely too much.

FRED A. HALSEY.

New York.

Counter-Balancing Engines.

Editor American Machinist:

As a number of your readers have written articles on the above subject, I will endeavor to give an account of a new method of counter balancing which I lately saw carried out upon an engine of (supposed) first-class make. This engine is a quick-running one, with automatic cut-off adjustment, and of about fifty horse power. Upon examining engine and the foundation, I regret to state that the latter consisted of two stilts (so to speak) built square up and down, which, in my opinion, shows poor judgment, especially for a high-speed engine. This kind of an engine should be set on a foundation having a large base, built in a tapering form under the whole length of the engine; then the engine would, without a doubt, have run steadier. Upon examining it, I found that the fly-wheel was keyed on in a very poor way. Here let me ask, will machinists ever learn to abolish the system so often practiced, of fitting the key both top and bottom? It is always sure to produce bad results, such as springing the shafts. It will always have a tendency to cause a pulley or a wheel to wabble sideways, especially if the shaft is smaller than the hole. The foregoing may seem out of place here, as the subject is upon counterbalancing engines, but it will be seen by the casual reader that to counterbalance perfectly it is essential that the parts should run true. As the wheel on the engine, which, so far as I had an opportunity to examine it, was keyed in the above manner, it will be seen what effect it had on the bearings, especially upon the crank pin. Is it to be wondered at that hot bearings so often occur? This engine, when running, was continually swaying at each stroke of the piston. The regulator, which is of the isochronal type, also had the trouble of wabbling. To steady the engine it was thought best to try and balance it. This was done by winding around the rim of the fly-wheel some two hundred pounds of iron chain. Now and then there was a stoppage to wire the chain together again, with an occasional stop to put back a bolt or nut which had got out of its place in some mysterious manner. This method does not speak very well for the makers. I shall have occasion to refer to this engine and to a still larger one hereafter.

C. E. SIMONDS.

London St., East Boston, Mass.

Experimental Mechanics.

BY OBERLIN SMITH.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

There is in this country a field of mechanical work, which is of vast importance to its industrial interests, and even to pure science; but which has never been occupied in any systematic way. I refer to experimental mechanics—the ascertaining by tentative methods the fitness, strengths and qualities of different materials, and their behavior under various strains, motions, processes and continued uses; of their best forms and proportions when worked into parts of machines, and like considerations.

This work has, so far, been chiefly done by individuals, as they felt its absolute need in inventing and developing various machines. Some of it has been done by the National Government, principally to meet its own necessities in naval matters; a little, in the way of testing boilers, to enable it to enforce its steamboat laws. Other portions of the field have been occupied by solitary scientific students and by learned societies, colleges and technical schools; *e. g.*, the Stevens Institute, with its valuable tests of strength, and elasticity of metals.

In France there is, I believe, some work of this kind done at Government expense; but I have forgotten to just what extent—probably less since she has become a republic, than when under the "one man power" *régime*. In this country we can hardly hope that our Government will, in our time, be sufficiently under scientific influence, or alive to the magnificent industrial economy of the expenditure, to devote a few millions to the endowment of a great National University of Experimental Science, with its corps of well-paid professors, selected from the ablest talent of the world, and its thousand earnest students—all at work making records, which would speedily be recognized as standards of technical practice.

In default of this, the work must be done, as heretofore, by our chemists and engineers, and mechanics and electricians. It may be, however, that the time has come for the introduction of more method and system, in order that efforts which are now wasted in needless duplication may be devoted to more accurate *finishing* and *recording* of experiments, and making them accessible to the mechanical public in a properly indexed form. Incomplete experiments are the rule rather than the exception, when performed by individuals in furtherance of some industrial result. This is simply because the required time and expense deter them from going any further than is absolutely necessary for the case in hand.

Apropos to this part of the subject, I have, in common with others, experienced on numerous occasions the want of a little systematized and "get-at-able" knowledge about some very simple matters. I have, however, always been obliged to fall back upon private experiments, which, in the nature of the case, would have been too expensive if made thorough enough to be of public value.

To select a few instances: case "A" was regarding common spiral springs—the principles governing their action; the pressure to be obtained with a given motion, with given material, given diameters of coil and wire, and given pitch and number of coils. Nobody knew.

Case "B" was in relation to "drawing" sheet metals—where a flat disc of tin-plate, brass or other thin metal is drawn cold into a cylindrical or conical form. Who knows the sizes of these discs to form a given depth and diameter of pan or box? Only those manufacturers who have accumulated hundreds of samples, finding the disc sizes by actual trial (involving oft-times tiresome alterations to expensive dies), from which they can guess approximately the dimensions for new patterns, which they may wish to make.

Case "C" related to permanent magnets. How short could they be in proportion to their thickness? What attractive power had they in proportion to their weight, when magnetized to saturation? What time was required for such saturation with a given hardness of steel and a given strength of electrical current in a surrounding helix? Would very minute magnets (say grains of steel dust) behave proportionately as larger ones, etc.

Case "D" was the simple question:—How fast is it safe to run an ordinary grindstone, and what is its bursting speed? A letter to a prominent grindstone manufacturer elicited the reply that he did not know, but that Messrs. So and So ran their stones so fast and found it about right.

In regard to case A, I wrote to gentlemen eminent for scientific research concerning the elasticity of metals, and also to a well-known spring maker. None of them happened to have studied the properties of springs. In relation to case C, I consulted one of our most celebrated electricians. It so chanced that he had never specially investigated the properties of permanent magnets; so in all these cases I labored on alone, having also failed to find the desired information by referring to some of the principal mechanical dictionaries, electrical manuals and engineer's handbooks. Perhaps the knowledge searched for is known to somebody and published somewhere, but it certainly is not readily accessible, as it is in the case of the steam engine. The latter machine has attained a dignity in the mechanical world that has given it a literature of its own, and all the proportions necessary to a good engine can be found given in detail in printed tables. This is to some extent true in regard to cotton machinery, and is beginning to be in plumbing work, and a number of other industries.

It will be seen that the main idea attempted in the foregoing remarks is, that the makers and users of machinery in this country should, for their own pecuniary benefit, as well as for the interest they may feel in applied science, *combine* to establish some sort of a *central council* for experiment and research. The *personnel* of this council should include such a number of mathematicians, phycisists, engineers and mechanics, all of the highest ability, as would give it the respect and allegiance of the mechanical public. Its *materiel* would be buildings, apparatus, record books and the best attainable scientific library. Its *work* would be: 1st, the publication and distribution of official information regarding any technical subject which the members should think of sufficient importance, and which might be suggested by themselves, or by any correspondent who needed or desired its investigation; and 2nd, the fixing of standard sizes and proportions where uniformity of practice is desirable. Its *methods* of work would be literary research, correspondence with practical men, mathematical calculation and mechanical experiment. The latter, however, could in many cases be dispensed with. To collect, compare, average and simplify records of other people's experiments and practice would be all sufficient.

A notable instance of such work was the fixing of the excellent "United States Standard" for bolt threads, nuts and heads, a few years ago. It was the combined work of *individuals* (the Messrs. Sellers) for their own practice, a *society* (the Franklin Institute) for the promotion of science, and the United States Government, which latter made it but semi-authoritative by deciding to adopt it in the navy merely.

The important questions arise for consideration, *when*, to *what extent* and *by whom*, shall this work be done? To the first a natural answer is—*now*. The second depends somewhat upon the third, and upon the money and enthusiasm at command. The third answer is respectfully referred to the American Society of Mechanical Engineers, with the hope that, if the subject should seem of sufficient importance, it will be properly discussed. It may be that your learned body, representing the best scientific and mechanical talent of our land, will, now or at some future time, see fit to make a beginning in this desirable work. Should such be the case, the possible methods of action are various. A practicable way might be to secure co-operation, and to bring about a systematic division of labor among the societies and schools that are already at work, thus increasing their efficiency many fold. Independent action might be the better method, and, however small the beginning, a nucleus would be formed, around which would, in time, accumulate the intellectual and pecuniary offerings of a grateful and appreciative engineering public.

Should not the engineers of America, to maintain their credit at home as well as the great reputation they have gained abroad, see to bringing about a time when a peregrinating journeyman will not have to master a new system of hieroglyphics upon the drawings at every shop he works in—when every shop owner will not have to select to suit his fancy from a dozen assorted brands in buying a wire gauge; and figure out twenty different sized pulleys to coax on to his line shafting to drive twenty "eighteen-inch" lathes; and puzzle his brains establishing for himself standard sizes and angles for nut bevels, and machine screws, and key-seats, and loose collars, and drawing boards; and find in his mechanical dictionary half a dozen speeds, varying some 500 per cent., as each and all correct for turning cast iron—when he will not need to build a metal-testing room of his own—a time, in short, when *one* well done calculation or experiment shall replace a *thousand* half done, and system shall replace chaos?

Foreign Technical Notes.

Translated for the AMERICAN MACHINIST.

INGENIOUS CONTRIVANCE FOR SEPARATING ORE.

Der Masch. Constr. says that M. M. Siemens and Halske, the eminent electricians, of Berlin, have just devised an appliance capable of separating at least 20 tons of ore daily It consists of an inclined steel shaft, fitted with an endless screw of brass, and surrounded by a brass tube open at its upper surface. The tube is mounted inside a hollow cylinder compo-ed of a series of parallel iron discs, separated by brass hoops and connected by iron rods. This constitutes a series of magnets the annular poles of which form the inside of the cylinder, the magnetization being effected by means of insulated wires rolled round inside the hollow cylinder. It is here that the magnetic particles yield to the attraction of the annular magnets, and are carried by the rotary motion to the upper portion of the cylindrical surface, until they meet a baffle plate, which deflects them on to the screw. Falling through the slot on the upper surface of the tube they are carried along by the revolving endless screw, and pass out into a schute at the end, the particles which are not magnetic slip along the bottom of the hollow cylinder without being attracted by the magnets, and pass out by a separate schute.

NEW APPLICATION OF THE SUB-PRODUCTS OF COAL TAR.

According to the last number of the St. Petersburg *Technological Review* a Mr. Saunders of that place has succeeded in producing from the heavy oils of coal tar, a new substance, which, in many cases, takes the place of india rubber with the greatest advantage. It is prepared in the following manner: A given weight of a mixture in equal parts of wood oil and coal tar oil, or of coal tar and hemp oil, is heated for several hours, at a temperature of about 318 degrees Fahr., so as to disengage the injurious substances and increase the viscosity of the mass until it may be drawn out in threads. A second quantity, equal to the former, of linseed oil, preferably thickened by boiling, is now added, and also from one-twentieth to one-tenth per cent. of ozokerit with a little spermaceti. In the meanwhile, the mass is kept at a uniformly high temperature for some hours, when from one-fifth to one-half per cent. of sulphur is added, after which the product is moulded, or otherwise worked in the same manner as india rubber.

The proportions of the three oils named above, may be varied so as to obtain a harder or a more elastic substance, as may be required. The product is elastic and tenacious, standing the weather much better than india rubber, and is not deteriorated by great pressure or high temperature. It is said to be specially suitable for the insulation of telegraph wires, and may be employed alone or mixed with india-rubber or similar resinous substances.

LUBRICATOR FOR STEAM ENGINES.

Jernskontoret gives a description of a new form of lubricator, constructed on what is known as the displacement system, and which has answered admirably. It is entirely self-acting, requiring no further attention than that of filling the cup with tallow, oil or other lubricant about once a day. It is especially adapted for steam engines. In these lubricators the peculiarity of construction is that inside the cup proper there is an inner vessel, a small annular space being left between the two. The annular space and the inner chamber are connected by means of small perforations in the inner vessel near the top.

NEW FEED AND AIR PUMPS.

The *Monit. Ind.*, in giving a description of these pumps, points out the improvement of a metal valve, which is used in the air pump to obviate the many inconveniences which arise from the use of india rubber. Also, that the bottom valve in the feed pump is formed with a long spindle; is made a working fit in a hole bored in the pump plunger; which spindle becoming coated with grease, causes sufficient friction to lift the valve at the commencement of the up stroke of the plunger, and keeping it open during the stroke, thereby leaving a free passage for the water; and to close it at the commencement of the down stroke, thereby compelling the water in the pump barrel to pass through the top valve. The bottom valve in the air pump is made in the piston, which is allowed a small amount of vertical motion on the piston rod, and is so arranged that on the down stroke the friction of the packing against the bore of the pump raises it thereby leaving a free passage through the valve; and on the up stroke presses it down, and so closes the passages, thereby compelling the contents of the pump barrel to pass through the top valve, which is also constructed of metal, and closes by the action of a spring on the top, or otherwise.

Newly Incorporated Companies.

NEW JERSEY.

Gas Light Transportation Company, Jersey City; Hugh J. Hastings, John Hoey, John R. Macpherson and others, incorporators; Capital, $25,000,000. To transport illuminating gas, by pipes or otherwise, from various points in the State of Pennsylvania and elsewhere, to various points in the States of New York, New Jersey, Pennsylvania, Maryland and elsewhere, and to supply and sell gas to gas companies and other corporations and persons.

F. M. Weilers' Liberty Machine Works, Union, Bergen County; Peter R. Weiler, Frank R. Weiler and others, incorporators; Capital, $55,000. To manufacture and sell printing machinery and materials, paper cutters, etc., etc.

Cape May and Schellinger Landing Railroad Company, Cape May; O. S. Hanna, George J. Richardson, Wm. Richardson, Edward S. Taylor and others, incorporators; Capital, $40,000. To construct and operate a railroad from or near "Sea Breeze Hotel" in Cape May City, to Schellinger Landing, a distance of about 2¼ miles.

The Chase-Hadley Company, Jersey City, N. J., and Boston, Mass.: Daniel E. Chase, Edward Hadley, John B. Taft and Edward Hamilton, incorporators; Capital, $100,000. To manufacture New England rum from molasses and other distilled spirits.

MASSACHUSETTS.

The Brown Manufacturing Company, Milford; Wm. F. Draper, President, Geo. S. Brown, Treasurer; Capital, $25,000. For the manufacture and sale of cotton yarns.

Plymouth Foundry Company, Plymouth; Wm. H. Nelson, President, Matthias Pratt, Treasurer; Capital, $35,000. For the manufacture of castings and other metals.

N. Ward Company, Boston; Francis J. Ward, President, Andrew J. Ward, Treasurer; Capital. $100,000. To collect and render animal matter of all kinds, manufacturing the products thereof, and glue, fertilizers and chemicals of all kinds.

The Midland Improvement and Construction Company, Boston; Wm. J. Best, President, Wm. S. Denny, Treasurer; Capital, $500,000. To aid in the building, construction and equipment of railroads; to enter into contracts with railroad corporations, or individuals having rights or interests in or pertaining to railroads or railroad charters or franchises for the construction or equipment of the same or the furnishing of the same with supplies.

The Charles River Steam Navigation Co. Waltham, Harvey P. Bartlett, Pres., Eldridge M. Illingworth, Treas. Capital, $5,000. For carrying passengers on steamboats on Charles river, from Waltham to Auburndale and Weston, with right to own and maintain steamboats and other vessels and boats to hire.

Brown Manufacturing Co., Milford, Wm. F. Draper, Pres., Geo. S. Brown, Treas. Capital, $25,000, in shares of $100 each. For the manufacture and sale of Cotton Yarn.

NEW YORK.

The New York and Flushing Lumber and Building Company, Limited, Flushing; J. Milner Peck, Isaac Peck, Geo. W. Peck and others, incorporators; Capital, $250,000. To manufacture and sell lumber and all articles used in the construction of houses and other edifices, and the manufacture and sale of portable houses and other edifices for export and domestic trade.

Knob Lock Company, New York; Geo. W. Tallman, Almon H. Bondebush and Wm. Fowler, incorporators; Capital, $1,000,000. To manufacture and sell locking latches and door locks.

Isham Wagon Company, Plattsburg; H. L. Isham, Wm. E. Smith, W. G. Wilcox, and others, incorporators. Capital $100,000. For the manufacture and sale of wagons and sleighs, and parts thereof.

"Rome Spring Wagon Company," Rome, N. Y.; Louis Roth, John R. Munro, Lauren M. Fitch and others incorporators. Capital, $13,000. To manufacture and sell wagons, carriages, sleighs and other vehicles, and gearings, springs, and appurtenances belonging thereto.

"Davis Tri-cycle Coach Company," Elmira, N. Y.; Robert W. Davis, Arthur W. Davis and Edwin A. Scott, incorporators. Capital, $150,000. To manufacture and sell wagons and vehicles of all descriptions, and the various belongings, attachments and parts thereof.

The Excelsior Barrel and Oil Company, of New York; Alphonzo W. Bly, Horace K. Thurber, Watkin T. Jones, Edward Smith and James S. Barson, incorporators. Capital, $125,000. To manufacture, transport and sell petroleum and products of petroleum, and other oils; also to manufacture, use and sell articles for use in manufacturing and trading in such oils.

ILLINOIS.

Illinois and Indiana Coal and Railway Co.; Charles J. Barnes, John S. Kendall, Thos. B. Seavey, and Leonard E. Ribold, of Chicago, incorporators. To build, construct, equip and operate a line of railroad, commencing at the town of Effingham in the county of Effingham, Ills., and running in an easterly direction through said county, to and across the counties of Jasper and Crawford, to the line of the State of Indiana. Capital, $1,000,000. Principal office—Chicago.

Brosins' Belleville Oil Works; John Brosins, August Lenz, and Hermann G. Weber, incorporators; To buy and sell seed, and manufacture castor, linseed and other oils; also fertilizers. Capital, $40,000. Location, Belleville.

Chicago and Western Indiana Belt Railway Company; Andrew Crawford, Joseph T. Torrence, Charles B. Sawyer, Arthur N. Sullivan and John A. Baker, incorporators. To construct and operate a line of belt and transfer railroad, with branches to intersect and connect the several lines of railroad, now constructed or hereafter to be constructed, to and into the county of Cook, State of Illinois. Capital, $500,000. Principal office, Chicago.

The Singleton Silk Manufacturing Company, Dover; Alpheus Breemer, George Singleton, Wm. H. Baker, and others, incorporators. Capital stock, $60,000. To manufacture silk, cotton and woolen goods, &c.

PENNSYLVANIA.

McLaughlin's and Saw Mill Run Railway Company; Capital, $60,000; Office, McKee's Rock, Allegheny County; Henry Hice, Beaver, Pa., Jacob Henrici, Economy, Beaver County, Pa., John G. MacConnell, Pittsburgh, Pa., and others, incorporators. To construct a railroad from the terminus of The Charters and Mansfield Valley Railroad to Sodom on the line of the Pittsburgh Southern Railroad, a distance of about six miles.

Broad Mountain Railroad Company; Capital, $50,000; Office, Mauch Chunk, Pa.; T. Frank Walker, Frederick Bertolette, J. M. Driesbach, all of Mauch Chunk, incorporators. To maintain and operate a railroad from a point on the Lehigh Valley Railroad Company, near Delano, in Schuylkill County Pa., to the middle Lehigh colliery town of New Boston, said county, a distance of five miles.

The Benton-Belfontaine Street Railroad Company, having obtained proper authority to do so, intend placing a powerful four-point electric light on the terrace of the water tower in the northern part of the city of St. Louis, the motive power and necessary machinery being located in the company's stables, some two squares distant. The water tower is claimed to be the highest pure Corinthian column in the world, measuring 225 feet from the foundation to the terrace. The ground on which it is located is 110 feet above the high-water mark on the levee, which will place the lamp more than 300 feet above the larger portion of North St. Louis. It will be visible from St. Charles, Edwardsville, Ill., Alton, Belleville, and at surrounding towns within a radius of fifty miles. The cost of the lamps and machinery will be about $5,000, and it is expected that it will be in operation in a few days.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.

JACKSON BAILEY, Vice-Prest.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

The American News Company,

Publishers' Agents, New York.

The International News Company,

(Formerly the Wilmer & Rogers News Co.)

11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.

Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

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NEW YORK, JUNE 18, 1881.

CONTENTS.

PAGE.

The Shaw Locomotive..... 1
Venting Green Sand Moulds. By Thos. D. West.. 2
Cooling by Artificial Means..... 3
Machinists' Calipers..... 3
New Gun Milling Machine..... 4
Machine Architecture. By F. F. Hemenway..... 4
Letters from Practical Men—Essentials for Mechanical Drawings—Arcs and Chords—Technicalities in Working Drawings—Line Shafts and Couplings—A Convenient Tool—Chordal's Bolt Drawing—The Mississippi Engine Again—Fast Melting of Iron—Friction Contact and Power of Belts—Counterbalancing Engines.....4, 5, 6
Experimental Mechanics. By Oberlin Smith..... 6
Foreign Technical Notes..... 7
Newly Incorporated Companies..... 7
Shall we Have a World's Fair?..... 8
Some Topics Treated by Our Correspondents..... 8
Never Too Old to Learn..... 8
Literary Notes..... 9
Questions and Answers..... 9
Manufactures..... 9
Machinists' and Engineers' Supplies..... 10
Iron and Metal Review..... 10

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Shall we Have a World's Fair?

Boston has developed a great deal of enthusiasm over industrial exhibitions this year. Besides holding two grand mechanical fairs this fall, in the two new buildings now being erected for that purpose (which have been illustrated in the AMERICAN MACHINIST), Boston is reaching out for a World's Fair in 1885, and, so far as heard from, will not wholly depend upon the railroads having their termini in that city to subscribe the necessary funds to insure carrying out the undertaking. But what has become of the World's Fair Commission, that was to carry out the proposed plan of holding an international exhibition in New York City in 1883? If there remains any vitality in that Commission, the occasion has arisen to assert itself. If the Commission is virtually defunct (as there is good reason to believe), let its obituary be written, and all other obstructions removed from the way of the original Committee that first called public attention to a proposed World's Fair in this city, at some date to be afterwards named. Had that committee been allowed to continue its efforts without interference from any rival organization, we should probably have heard of no efforts to hold the fair in any other city than New York. If the World's Fair Commission, as constituted by Act of Congress, will now give notice of withdrawal, it is not too late for the originators of the project to take it up again, and carry it out successfully upon a scale of greater magnitude than anything of the kind that has hitherto been attempted.

Some Topics Treated by our Correspondents.

Our "Letters from Practical Men" this week bear increasing evidence that the interesting part of the discussion upon practical methods in mechanical drawing is by no means exhausted. We are glad that this is the fact, and feel that it is not necessary to explain why we have already allowed the subject to occupy so much of our space. The literature of mechanism would be as crude without detail shop drawings as would geography without maps, or navigation without the mariner's compass. What is it that, more than anything else, distinguishes the mechanical engineer from the ordinary journeyman mechanic? Is it not the ability to make accurate and intelligible detail drawings of any machine which it is desired to build, or of any machine already built? When a skilled mechanic has become familiar with the draughtsman's art, he has made a long stride towards qualifying himself as a mechanical engineer. The art is not shrouded in mystery, but is open and accessible to almost any mechanic who wishes to apply a portion of his leisure time to its acquirement. While the discussion has been going on in our columns, we have received a number of letters from apprentices and others, who wished to take up the study of mechanical drawing, inquiring how to begin and what course to pursue. We could answer these but briefly by mail; and for the benefit of such will, at no distant date, give at length in these columns something more explicit and easily followed. The articles will be from the pen of a writer widely recognized on both sides of the Atlantic, as possessing not only the requisite knowledge, but the ability of and experience in imparting the necessary instruction.

One of our correspondents sends a second contribution on the Western river engines. Our Eastern readers, especially, will be much interested in the description in detail of these engines. We should be pleased to have sketches of early Western steamboats and their machinery sent us by those who remember the details sufficiently well to write them out. Reminiscences of Western river engineering will also be acceptable.

Line shafts and couplings are overhauled by one correspondent in a way that suggests the need of closer attention to their selection and arrangement in many shops.

Every shop is interested in tool-posts, and the continuation of practical suggestions in regard to them will not miss of accomplishing some good.

An Oswego correspondent shows how special skill is sometimes made highly valuable in an iron foundry. Many founders who are melting but five tons an hour in a cupola, and who wish to melt seven tons an hour, would think it necessary to put in a new cupola. But in the case, of which particulars are given on page 7, it was shown that all that was necessary to get that increase was to put in a new manager, just long enough for him to demonstrate that it could be done, and explain how to do it.

Never Too Old to Learn.

We frequently receive inquiries, particularly from our young friends (28 years of age and under), who ask us substantially the following questions. "Am I too old to learn the machinist trade?" or, "Can I learn to be an engineer, and how long will it take?"

We are pleased to receive such inquiries, for it proves that the young men are enterprising, and desire to adopt the best and most desirable course for obtaining a livelihood. Some men—some mechanics in particular—are too apt to get the idea that there is a certain stage in their existence when they are to possess all the knowledge required to carry them through life, and that further effort is unnecessary. This is not only erroneous, but is a very dangerous position to get into; for when any person allows himself to be influenced by this supposition, his progressive course has stopped.

A young man should start out with the determination to make progressive improvements so long as he lives. Some of the most brilliant scholars that the world has ever known have been those who have come to the front after they were well advanced in life. For examples: Socrates after he had attained an extremely old age learned to play musical instruments; Cato at 80 learned the Greek language; Boccacio was 35 when he began the study of light literature, yet he became one of the greatest masters of the Tuscan dialect; Franklin did not fully commence his philosophical pursuits until his 50th year; Dryden in his 68th year commenced the translation of the Illiad, his most pleasing production.

A few months since there was a student, upwards of 70, studying a special course in chemistry in the Massachusetts Institute of Technology.

We would not discourage the young beginner, or place the slightest obstacle in the way of his substantial progress; yet can not but observe that young men are sometimes inclined to get the idea that as soon as they begin to study they ought to be entitled to a profitable position. We could point out many instances that have come to our notice where young men have studied too hard, advanced too rapidly, and at the age of 30 found themselves complete physical wrecks.

The greatest works, as a rule, have been performed by men who have come to the front in more advanced years, and who had but a limited education in their boyhood. We say to every one who has any desire to rise and accomplish any great or important undertaking to study a reasonable season every day, and to reach out into the future with full confidence, ever remembering that he who puts forth only a part of his efforts attains only a partial success. Some persons point out instances of what they call *luck*, where certain individuals have succeeded without any apparent effort. We never saw what we considered a case of genuine luck, for in every case which we took the pains to investigate a plain cause was apparent for the success of the individual. Men who have the best advantages when young do not always win, and men who make the best start do not always maintain their advantages, the cause being, in many cases, simply that they were not geniuses, or did not realize the essentials of their profession. The individual who has been born wealthy, and has learned what he knows by study alone, does not realize the force of the command, "Thou shalt earn thy bread by the sweat of thy brow." He cannot appreciate it. It should be borne in mind that talent abused becomes talent lost. Every one does not have an equal chance with his neighbor; hence, just praise cannot be given to him who has had the most advantages.

Many men are to blame for their slow progress, because they are constantly employing their time with things which not only do them no good, but actually help to belittle them in the estimation of society. For instance, an employe will speak disparagingly of his employer, and the employer will speak evil of the employe. This state of affairs is certain to raise a storm in proportion to the time it is allowed to continue. These, and a thousand other foolish things, occupy the valuable time that a man ought to give to study.

Every married or unmarried man can find time every day for study, and should never be heard to say, "I am too old to learn."

The American Society of Civil Engineers will hold its Thirteenth Annual Convention at Montreal, June 15th. Sessions for professional discussion, and one for the transaction of business will be held.

The following papers are announced for presentation during the Convention:

Re-enforcement of the Anchorage and Renewal of the Suspended Structure of the Niagara Railroad Suspension Bridge: L. R. Buck.

The Stability of Tunnels in River Silt: Ashbel Welch.

Repairs of Masonry: O. Chanute.

Experiments upon Strength of Wrought Iron Columns: T. C. Clarke.

On Weights and Measures: Charles Latimer.

Comparative Economy of Light and Heavy Rails: Ashbel Welch.

Circulars giving all necessary information may be obtained from the Secretary, John Bogart, 127 East Twenty-third Street, New York.

A subscriber asks: Will some one please give a plan for rigging a brush for keeping belts clean as they run, particularly around dry grindstones?

The Swiss representatives abroad have been instructed to ascertain the views of the various States relative to the adoption of an international law regulating the hours of labor in factories.

Literary Notes.

The Carpenter, "A Monthly Journal for Carpenters and Joiners," is a bright little trade journal hailing from St. Louis. Vol. I., No. 1, is before us, printed partly in English and partly in German. It is to be published by the Carpenters' and Joiners' National Union at 50c. a year. It says in its prospectus:

"We will strive to uplift the standard of workmanship in the craft, and keep our readers fully informed on all discoveries and matters of practical interest to the trade. For that purpose we will devote a department to technical carpentry, and we hope to soon be able to publish diagrams and designs to illustrate the subjects."

One of the best things the members of Carpenters' Unions can do is to sustain a journal of this kind devoted to their interests. Address P. J. McGuire, 911 N. 19th Street, St. Louis, Mo.

The Millstone, of Indianapolis, Ind., comes out for May in an entire new and tasteful dress, showing many improvements. The size of the paper has been reduced, and more pages added. It will be sent from now until the end of 1882 for the small sum of 50 cents. David H. Ranck is editor and proprietor.

The Tradesman of Chattanooga, Tenn., is the only journal, so far as we know, in the South regularly devoted to manufacturing interests. It has recently enlarged and

donned a new cover. We are glad to see evidences of its prosperity, but would esteem it more highly, if, when it copied an article from our columns it would give credit.

ELECTRIC LIGHTING BY INCANDESCENCE, AND ITS APPLICATION TO INTERIOR ILLUMINATION. A practical treatise with 96 illustrations. By Edward Sawyer. 8 vo. Published by D. VanNostrand, New York.

As the title of this book indicates, it is devoted chiefly to a description of incandescent electric lamps for lighting public buildings and residences. The subject of lighting by the voltaic arc has been omitted, but considerable space has been devoted to electric generators, which constitute the beginning and the end of every system of electric lighting. The work is not devoted to the criticism of other experimenters, or to the advancement of any. Some advice is given by which the inventor may be encouraged to work in the most fruitful channel. The new forms of incandescent lamps are described, and the book is a treatise which will be of service to the practical man who has to do with electric lights. The book is well printed upon good paper, but some of the illustrations are exceedingly poor.

USEFUL INFORMATION FOR STEAM USERS AND RULES FOR ENGINEERS AND FIREMEN FOR THE MANAGEMENT AND CARE OF STEAM BOILERS. Price, 25c. Published by the J. N. Mills Publishing Co., 165 Broadway, New York City.

This little book is a condensed treatise upon the steam engine and boiler. It was gotten up particularly for dealers to give to their customers for the purpose of instructing them in the care and management of engines, boilers and their appurtenances. In advising the customer what to buy, and directing another how to use it, the authors have displayed unusual liberality, as this is an exceedingly difficult problem to master.

WORKING DRAWINGS—HOW TO MAKE AND USE THEM. By Lewis M. Haup, Professor of Civil Engineering, University of Pennsylvania. Published by Jos. M. Stoddard & Co., 727 Chestnut Street, Philadelphia, Pa.

This book is a plain, comprehensive treatise on working drawings. The consideration of the subject is limited to straight lines and planes; but enough is given to enable the teacher to measure the capacity of the student, and to determine whether he has the elements necessary to continue the subject with profit in its application to curved lines, curved and warped surfaces, and solids. Those who desire to become successful engineers or artisans must pursue the course and take up the various subjects of intersections and developments of surfaces and solids, as applied to pattern-making, machine-drawing, stone-cutting, and many other of the useful arts which the author expects to provide in subsequent numbers.

The necessity of such instruction is becoming every year more urgent, in consequence of the abolition of the system of apprenticeships. There is probably no means of meeting this difficulty so rapidly and cheaply as a thorough groundwork in the principles of projections, as applied to making and reading working drawings.

LEFFEL'S CONSTRUCTION OF MILL DAMS, AND BOOKWALTER'S MILLWRIGHT AND MECHANIC, illustrated by numerous full-page plates. 12mo, cloth, 285 pages; price, 50c. Published by Leffel & Co., Springfield, Ohio.

The first part of the above work is a revised edition of a book formerly published on the same subject by the same publishers. The book referred to was large, bulky, and expensive, while this book contains more matter, and in less space.

The principles involved in constructing the noted dams of the world are given, as well as the proper materials used in dam construction. Practical directions are also given for building cheap and economical dams in special places, where the river bottom would not permit the building of stone dams. The second part of this book contains a valuable table for computing the loss of head due to friction of water in pipes, also other practical data connected with the economical operating of mills.

There are numerous wrinkles and recipes given for emergencies, and for use in such cases as are likely to occur within the practice of millmen.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(1) G. J. E., Dansville, N. Y., writes: I am building a foot lathe and wish to find some rule by which I can get the sizes for my cone pulleys. The distance between the centers of spindle and crank shaft is 22″. I wish to have two speeds. The small pulley and the spindle is to be of 3″ diameter, and the large one of 4½″ diameter, and the large pulley on crank shaft of 20″ diameter. I wish the small one proportioned according to your rule so as to use one belt. *A.*—If you turn the small pulley on your crank shaft so as to make its diameter 19 5-16″, the same length of belt will be right for both steps of the cone. Rankine's Rule for calculating the length is

$$\frac{ro=r1+r2}{2}+\frac{(r1-r2)^2}{6.28\,c}$$

in which c is the distance between the axes, $r1$ the radius of the larger end of each, $r2$ the radius of the smaller end, ro the radius of the middle.

(2) J. A. M., Wilmington, Del., asks: Will you please inform me if there is anything that will remove printing ink *fast colors* from a lithograph? *A.*—First apply some unguent or greasy matter to soften the ink, and then with some clean rag dipped in benzine, with care, the ink may be removed, but a stain will be left.

(3) J. W.S., Worcester, Mass., asks: Can you tell me of any way to give Bessemer steel a spring temper? *A.*—Bessemer steel contains an insufficient quantity of carbon to harden, and in order to harden it you will have to carbonize it still more. This may be done by placing the steel in a crucible in contact with powdered charcoal, and embraces the process called cementation. The lid of the crucible must be securely sealed while in the furnace. The character of the steel is changed in proportion to the amount of carbon absorbed, so that when you are done you will not have Bessemer steel, but an entirely different grade. Unless you are somewhat acquainted with steel-making processes, and have the proper facilities, you will experience some difficulty in producing a uniform quality of steel every time, and we would suggest that you procure steel having a sufficient quantity of carbon to harden. In many cases Bessemer steel is used for springs without any temper, and it answers very well when it is not strained beyond its elastic limit.

(4) S. N. W., Cheboygan, Mich., asks: Please inform me how to produce a fine blue surface on gun barrels? *A.*—Apply nitric acid and let it eat into the iron a little, then the barrel will be covered with a thin film of oxide. The barrel should then be cleaned, oiled and burnished.

(5) W. H. S., Milford, Mass., asks: Will you inform me the best way to temper taps and dies? *A.*—Heat them in melted lead, or what is far better, melted glass, which will give the articles a uniform heat, then quench in clean water of about 100° Fah. The articles should then be brightened, and the temper drawn by holding them within a muffle, or other suitable place, having a sufficiently high temperature to draw the temper to the point desired.

(6) G. E. T., Rome, N. Y., writes: I have had great trouble in hardening rivet dies for making belt rivets. They have a tendency to crumble off at the corners after being used a short time. Can you inform me which is the best steel for that purpose, and the best method of hardening? *A.*—We should judge from your description that in tempering the heat was not uniform. It has been found a difficult matter to heat steel tools uniformly for tempering, and the leading manufacturers have adopted the method recommended in answer to the previous question. Unless all parts of a tool before quenching have an equal temperature, there will be hard and soft spots. In regard to the quality of steel we recommend that you purchase the best tool steel from a reliable house in the trade, as there are a number of first class brands made by different manufacturers.

(7) L. W., Memphis, Tenn., asks: Will you give me a rule for compound gears for screw cutting upon a lathe? *A.*—See answer to first question in our issue of June 11, 1881.

(8) D. L., Montague, Mich., asks: Will you settle the question as to whether steel in the shape of chips or borings can be used with benefit in the foundry ladle mixed with molten iron; or can the same be used in the cupola in larger pieces mixed with the charge? Do you know of steel being used in any foundry? If so, with what results? *A.*—We have no results of tests being made with steel, but Mr. Hodgkinson, of England, some years ago, made some experiments with wrought iron borings and turnings, by incorporating them in different ways with molten iron. It was found that wrought iron in the shape of bolts and nuts, was put into the cupola, that it would not mix thoroughly with the cast iron, but remained in lumps as in a puddling furnace. The plan was also tried of putting wrought iron chips into the moulds. Another and very successful course was to put the wrought iron chips into the ladle after the iron had been drawn from the cupola, and stir them well together. The following are the results obtained in Mr. Hodgkinson's experiments: The bars tested were 1″ square, placed upon supports 4 feet 6″ between centers. The weight was applied at the middle. Scotch No. 1 hot blast unmixed broke at 430 lbs. The same iron with a mixture of 33 per cent. of wrought iron scrap broke at 713 lbs. The iron first named, with 20 per cent. of wrought iron scrap, broke at 650 lbs. Another kind of iron tested was Welsh cold blast unmixed which broke at 440 lbs., while with a mixture of 10 per cent. of wrought iron scrap, broke at 689 lbs. It would cost very little to try experiments with steel chips added in different proportions to a small ladle of molten cast iron. The result will be similar to the foregoing, being controlled by the care in which the mixture is made, and the proportions.

(8) G.G., Smithville, N. J., asks: 1. Why do not machinists cut a thread upon a lathe while running backward as well as in running forward? I never saw anybody do it, and have no experience myself in turning; but suppose there must be some very heavy objections, though there is much time wasted in letting the tool cut only one way? *A.*—To allow the tool to cut both ways would involve a complication of gearing, which has heretofore been found impracticable, but instead some manufacturers of lathes use a large pulley for producing a quick return motion. 2. I would state in reference to iron planers that I once saw one where the toolholder made a half turn every time the piece to be planed had passed it, and thus cut both ways, but I heard the workmen say that such a holder was not good for much, as it was too unsteady to do good work. Is there no better way to do it? *A.*—Planers are made with reversible tool posts, which, of course, enable the tool to cut both ways, but such planers are only adapted to planing off surfaces. The difficulties which are necessarily introduced with such devices has prevented them from coming into more general use.

BUSINESS SPECIALS.

50 cts. a line for each insertion under this head.

Dies, Punches and Special Tools, manufactured by H. H. Coles & Co., 446 N. 12th St., Philadelphia.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Steam Engines Indicated and Examined. Power Measured. W. H. Odell, P. O. Box 274, Yonkers, N.Y.

Bound volumes for 1880 of the AMERICAN MACHINIST.—We can furnish Vol. 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, neatly bound in cloth, ready to ship by express, for four dollars. AMERICAN MACHINIST PUBLISHING CO. 69 Fulton Street, New York.

Wood Engravings of Machinery and Tools. Satisfaction guaranteed. Chas. Murray, 58 Ann St., N.Y.

Wanted to arrange with responsible parties for the manufacture of a New Air Compressor. The best yet designed. John Fish, 8 Pine Street, New York.

Special Notice.—Owners and managers of large establishments throughout the country will find information of positive value in our 75 page illustrated pamphlet, entitled "Useful Information for Steam Users." It contains data on the care and management of Steam Engines and Boilers and Rules for Engineers and Firemen. Sent for 25c. in P. O. Stamps. The J. N. Mills Publishing Co., 165 Broadway, New York City.

Special inducements offered to clubs. "Extracts from Chordal's Letters" in book form, now ready. Cloth. 320 pages. Less than 5 copies, $1.50 by mail, each, postpaid. American Machinist Publishing Co., 96 Fulton Street, New York.

J. C. Hoadley, Engineer and Expert, formerly of Lawrence, Mass., has opened an office at 29 High St., cor. Federal, Boston, Mass., where he will be pleased to receive old and new friends.

Indication of Steam Engines a specialty. A. Wilkinson, Gen'l Office, Manayunk, Phila, Pa. Branch, 1116 Beach St., Phila., Pa.

A New Treatise on Steam Engineering, Physical Properties of Permanent Gases and of Different Kinds of Vapor. By John W. Nystrom, C. E., 8vo., cloth. Price, $1.50, also A New Treatise on the Elements of Mechanics, Establishing Strict Precision in the Meaning of Dynamical Terms. By John W. Nystrom, C. E., 8vo., cloth, price $2.00. Mailed by E. & F. N. Spon, 446 Broome St., New York City, on receipt of price.

For Sale—36-inch English Lathe; Screw Cutting and Back Gear, Bed 18 feet, turns 13 feet 25 inches over rest, with power cross feed, Compound Rest, center and follow rests, large and small face plates, extra tool-block for turning, full swing of lathe, New Haven Manufacturing Co. make, but little used, in first class order. Price, F. O. B., Poughkeepsie, $900.00. Sedgwick, Stuart Manufacturing Co., Poughkeepsie, N. Y.

MANUFACTURES.

The Niles Tool Works, Hamilton, O., are running day and night with a force of 250 men.

The Pacific silk manufactory has been incorporated at San Jose, Cal., with a capital of $50,000. A manufactory will be erected at once.

Morgan, Williams & Co., Alliance, O., are finishing for Oliver Bros. & Phillips, Pittsburg, a shear that weighs 68 tons and to cut 100 inches at one stroke. They have an order for another of the same size for J. H. Shoenberger & Co. They are adding 100 feet to their building, and placing a new engine of 60 horse power.—*Cleveland Trade Review.*

The cotton mills at Middlebury, Me., will be enlarged and a stock company with $200,000 formed, employing 300 hands. The mills have been idle for many years, until recently.

Carpenter & Bowen, Providence, R. I., are about to add to their foundry one building for general foundry purposes, 50x30, and a pattern room, etc., 40x20.

The old Camden and Amboy railroad shops at Bordentown, N. J., which have been idle for several years, have been leased to a New York party for thirty years, for the manufacture of locomotives.

The men employed in the pipe foundry of A. H. McNeal, Burlington, N. J., numbering about two hundred, have had their wages increased ten per cent., owing to the flourishing condition of business.

Grant & Bogert are designing new machine tools which will be built at their new shop in Flushing, N. Y. They have already made a set of patterns for a 14″ lathe. They have ordered a Buckeye engine of the Hartford Engineering Co.

The American Ship Windlass Company, of Providence, R. I., are laying the foundation for an addition to their works. It will be 100 feet long, 54 feet wide, and two stories and a half high. The first story will be for their windlass shop, the second for building the engines for their steam windlasses and steam capstans, and the third for storage.

The E. Horton & Son Co., Windsor Locks, Conn., are putting in some new milling machines and lathes to increase their capacity to supply orders for the Horton lathe chuck. The basement of the shop is now being fitted up with machinery to enlarge their facilities. The demand for their chucks was never before so large as it is now.

The Siemens-Anderson Steel Company, of Pittsburg, expect to have their new steel plant, consisting of four Siemens rotating furnaces, for making iron sponge direct from the ore, together with the necessary appurtenances for converting the same into steel, ready for operations by the 1st of August next.

Bath, Me., wants to try iron ship-building. At a recent meeting of business men there $100,000 was pledged for an iron ship-yard, and a committee was appointed to raise $200,000 more by subscription. Albert Hathorne is going to build this summer the largest ship ever launched at Bath, with a keel of 226 feet, a beam of 43½ feet, and a hold 28 feet deep.

The Portland (Me.) Stove Foundry Company are to erect three wooden buildings in that city, one, a foundry building, one story high with monitor roof and 100x65 feet in size; a workshop three stories high, 100x45 feet in size, and a warehouse three stories high, 100x45 feet in size; and will also put in a steam engine with boiler of fifty horse power.

The Hartford, (Conn.), Engineering Co. has just completed the first Hartford high-speed engine for the Billings & Spencer Co., of that city. These engines are building under the Buckeye patents, but with special features introduced by the engineers of this company, Messrs. Church and Barnard. They are now employing 175 men, and are regularly increasing the force.

The Missouri Car and Foundry Company of St. Louis have contracts for over a million dollars worth of work. Helmbacher's Forge is busy on heavy steamboat shafts, car axles and car couplings. There is not above 500 tons of pig iron on the St. Louis market that is not held against contracts already made, though there is a daily consumption of nearly four hundred tons.

The stockholders of the North Chicago Rolling Mill Company voted to increase their capital stock from $3,000,000 to $5,000,000, and also to buy with the $2,000,000 the plant of the South Chicago Steel Company, located at the mouth of the Calumet. The two concerns were really one, though having a separate organization, the stockholders of the North Chicago Rolling Mill Company holding all the stock of the Steel Mill Company.

One of our correspondents writes us that the pair of Corliss engines driving the Social Mill, Woonsocket, R. I., are developing 925 H.P. on 2⅜ lbs. of coal per H.P. per hour, which economy is largely due to the skill and energy of the chief engineer, Mr. Dimon, and the enterprising management of the agent, Mr. Nourse. The latter is willing to "give a practical engineer a chance to show what he can do."

The Plymouth (Mass.) Foundry Company have organized by the choice of the following officers: William H. Nelson, William R. Drew, James Millar, Thomas E. Cornish, Charles B. Stoddard and Geo. F. Weston, Directors; Matthias Pratt, Treasurer; Arthur Lord, Clerk. A code of by-laws was adopted, and the directors were authorized to purchase the property of the Plymouth Iron Foundry Corporation, at a sum not to exceed $15,000. The foundry will begin operations as soon as the necessary preliminaries are settled.—*Boston Commercial Bulletin.*

The Nashua Iron & Steel Company are about to ship from Nashua to St. Louis a steel hexagon shaft, claimed to be the largest ever manufactured in this country. Its extreme length is 33 feet 11 inches, the hexagon or free surface being 27 feet, and the journal 3 feet 2½ inches on either end. The diameter of the hexagon is 14¾ inches, and of the journal 13½ inches. The weight of the shaft, finished and ready for shipment, is 28,000 lbs. The shaft was made on a competitive order by the Nashua Iron & Steel Company, to show that shafts of an immense size and weight can be made in this country.

Machinists' and Engineers' Supplies.

NEW YORK, June 2, 1881.

The state of the supply market continues satisfactory as when last reported.

The New York Central Iron Works, Geneva, N. Y., have issued a new circular describing the Wm. B. Dunning's base burning magazine boiler for steam heating.

B. W. Payne, Corning, N. Y., have issued a descriptive circular and price list of their improved engines and boilers.

Iron and Metal Review.

NEW YORK, June 2, 1881.

Pig iron remains dull, but there is a little more disposition of consumers to buy. We quote No. 1, $24 to $24.50; No. 2, $22; Gray Forge, $20; Glengarnock, $22.50; Coltness, $23.50; Carnbroe, $22, and Gartscherrie $22.50 to $23. Bar Iron from stove remains on a basis at 2.5c. a pound for refined. There is not much doing in rails. Iron rails are quoted at $48 to $50, and Steel rails $56 to $60 at mill. Old T rails sell at $26.50 to $27.50. No. 1 Wrought Scrap sells at $29 from yard. Boiler iron and supplies are quoted as follows: Tank iron, 2¾c. to 3c.; Refined, 3¼c. to 3⅜c.; Shell, 3⅛c. to 3¾c.; Flange, 4⅝c. to 4¾c.; Fire Box, 5⅛c. to 5¾c.; Burden's Rivets, 5 1-10c. Boiler Tubes, 45 per cent. discount from list. Ingot Copper sells at 18¼c. to 18⅜c. Copper has advanced in London. Straits tin is quoted at 19⅛c. to 19¾c.; Australian, 19⅝c., and Billiton, 19¾c. Common pig lead is held at 4⅜c., and refined, 4⅝c. Western Spelter 5c. to 5⅛c., and Silesian Slater 5⅜c., are recognized prices; Antimony sells slowly at 14¼c. to 14½c.

WANTED

A mechanical engineer and draughtsman of 25 years experience, both in America and Scotland, and who has a moderate amount of capital, will shortly be willing to take a position in a machine shop as partner, or to co-operate in starting a new concern. Address BOX 14, AMERICAN MACHINIST.

Pattern Maker.—Wanted a first-class pattern maker who understands laying out and making gears, and the work of a general jobbing shop. Apply, with references, to John James & Co., La Crosse, Wis.

Wanted.—A first-class Draughtsman. Good designer on engine work and general machinery. Address, with reference, stating salary. Robt. Wetherill & Co., Chester, Pa.

Wanted.—Three first-class machinery moulders, accustomed to heavy work. None considered except strictly as above. Good pay and steady work if satisfactory. The Hartford Engineering Co., Hartford, Conn.

A Horizontal Boring Mill, 36 in. Swing, 12 ft. 10 in. bed. Weight, 10,000 lbs. Latest design, extra heavy, workmanship guaranteed first-class, for sale. Address Ohl & Co., East Newark, N. J.

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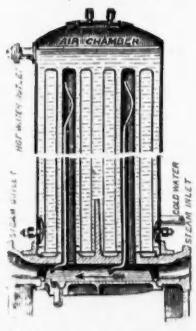

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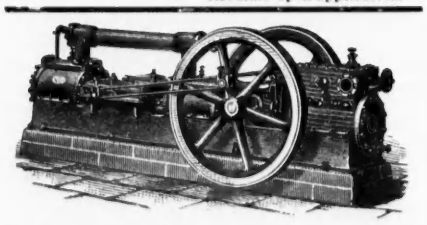

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The Norwalk Iron Works Co.

SOUTH NORWALK CONN.

FOR SALE.

A 34-inch Engine Lathe, with screw and back gear. Bed 8 feet, turns 3½ feet in length. Swings 21 inches over carriage. Has compound rest, swinging to any angle. Accompanying tool are countershaft, 24 inch independent 4 jaw chuck, 18 inch independent 3 jaw chuck, large face plate and stationary rest. Detroit build, and in first-class repair. Price, $500.00 on board cars in Detroit.

DETROIT IRON & BRASS MFG. CO., Detroit, Mich.

FOR SALE,

AT MIDDLETOWN, CONNECTICUT,

A valuable manufacturing property with water power, machine shops, foundry, forge shop, office, store houses, etc., one dwelling house, barn, and 2½ acres of land. Said premises are within 20 minutes walk of the post office and depot. For particulars, enquire E. ACKLEY, Esq., Middletown, or of E. G. PARKHURST, of the Pratt & Whitney Co., Hartford, Conn.

FOR SALE CHEAP.

Foundry, Machine, Blacksmith and Wood Shops, with paterns, tools and machinery complete. Will be sold separately or as a whole. Address

F. M. ROBINSON, Conneautville, Pa

HOUGHTON'S BOILER & TUBE COMPOUND,

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LOOSENS SCALE & PREVENTS ITS FORMATION.

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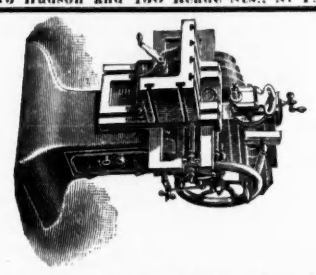

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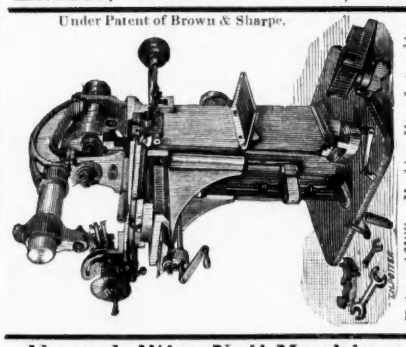

Universal Milling Machine, Manufactured by A. Alex. Pool & Co., Newark, N. J., U. S. A.

French Wire Nail Machines.

Wanted to join some party wishing to start a French wire nail manufactory. The advertiser has had twenty years experience in building wire nail machinery and in manufacturing wire nails. Knows every construction that has been tried. Will warrant his machines to run steadily on round head work (escutcheon pins) without expensive round dies. Address, BOX 10, AMERICAN MACHINIST.

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(Formerly Wm. Cooke, successor to Cooke & Beggs)

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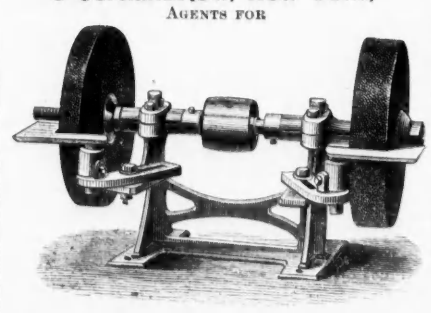

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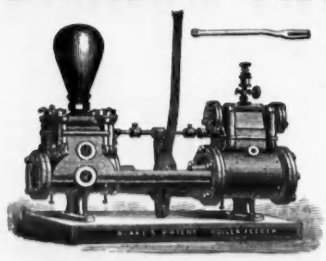

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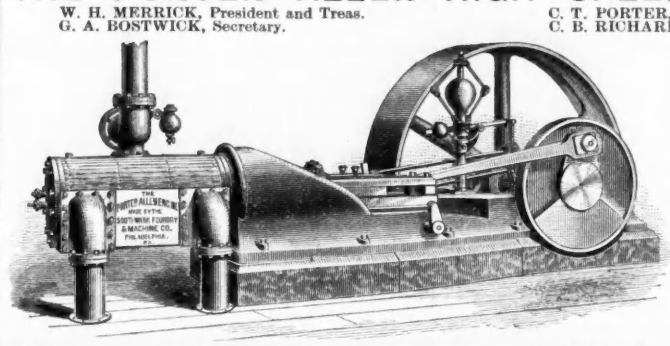

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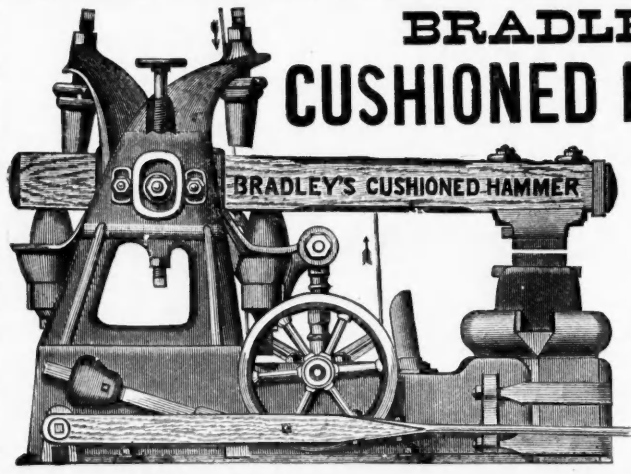

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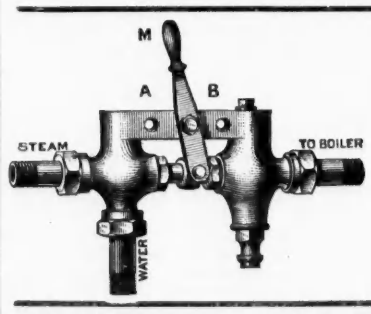

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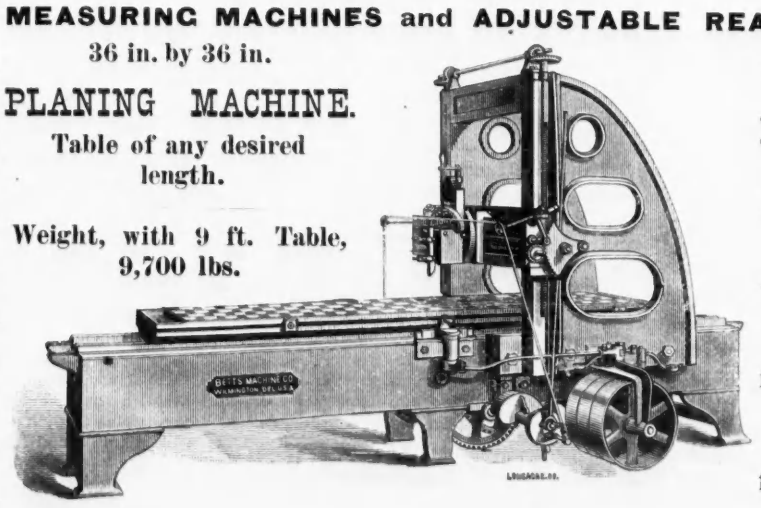

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